

Kokopnyama, where Hough records a wall elaborately decorated in color,¹ and the writer found geometric designs scratched upon the wall plaster of a kiva.

DOORS

We found only seven doors, a surprising fact considering the number of rooms opened. But when it is realized that until a few years ago practically all entrances to first floor rooms of historic Hopi pueblos were made through the roof, this condition will be understood. Even today in Oraibi, the oldest inhabited Hopi village, many rooms now partly buried by accumulations of sand and débris are still entered in this manner. There is hardly a room, either above or below ground, in Oraibi or villages on the Second Mesa, that at some time

Doorways

Room	Type	Width	Height	Above floor	Lintel	Width offsets		Height offsets		Remarks
						Left	Right	Left	Right	
R-3	Rect.	1' 7"	2' 2"	2' 6"	Sticks					Base of door is floor level.
R-10a	Square	1' 9"	1' 9"	— 6"	Stone					
R-11	Rect.	1' 6"	2' ½"	—	Sticks					
T-1	"	1' 4"	2' —	1' —	"					Partly destroyed.
R-23	?	1' 4"	?	2' 7"	?					
R-25	T-shape	2' 2"	3' 4"	2' —	Stone	— 6"	— 4½"	1' —	1' —	

FIG. 28.

the writer has not been permitted to enter. It was observed that in old dwellings on the ground floor which have for years been used for storage, entrance was usually made through the ceiling. The doorways at Kokopnyama were square to rectangular, or T-shaped. Dimensions in all vary (fig. 28). Lintels were either of split juniper sticks about 1½ inches in diameter set in adobe mortar, or of sandstone slabs.

CACHES

Caches used both for domestic and ceremonial purposes were found and the interiors of all were plastered. In some caches, corners were rounded with plaster and sometimes emphasized until the cache was

¹ Archeological Field-Work in Northeastern Arizona. The Museum-Gates Expedition of 1901. Ann. Rep., U. S. Nat. Mus., 1901, pp. 279-358.

oval or even circular while in others rounding was limited to the upper rear corners, producing an oval top. More often the lintel was a sandstone block of the wall masonry (fig. 29), but an exception is found in Room 11, where a cache is roofed with small sticks set into adobe after the manner of door lintels. Time has proved the strength of roofs made from adobe and wood, and it is not surprising that this knowledge should be used where a substantial covering for an opening is needed whether large or small.

Caches

<i>Room</i>	<i>Above floor</i>	<i>Width</i>	<i>Height</i>	<i>Depth</i>	<i>Plastered</i>	<i>Lintel</i>	<i>Wall</i>	<i>From corner</i>	<i>Remarks</i>
R-2	1' 5"	— 6"	— 6"	— 6"	Yes	Stone	N.	4' 9"—N. E.	Circular
R-11	2' 6"	— 8"	— 7"	1' 1"	Yes	Sticks	W.		Near middle of room.
R-15	2' 3"	— 8"	— 7½"	— 8"	Yes	Stone	S. E.	7½"—S. W.	Slightly rounded.
R-15	2' 3"	— 9"	— 7½"	— 8"	Yes	"	S. E.	4' 9"—S. W.	" "
R-18	1' —	— 5"	— 4"	— 6"	Yes	"	N. W.	4"—N.	No depth at top. Slopes backward and down to bottom.
R-23	2' 1"	— 7"	— 6"	— 5"	Yes	"	N. W.	3' 6"—N. W.	D-shape. In kiva.
R-23	?	?	?	?	Yes	?	N. W.	?	No measurements.
R-24	—	1' 6"	2' 7"	1' 3"	Yes	Stone	N. W.	7"—N. W.	Top oval. Slopes downward.
R-24	— 8"	— 6"	— 5"	— 8"	Yes	"	N. W.	2' 10"—S. W.	D-shape. Base flat. In kiva.

FIG. 29.

FLOORS

Floors were of clay, with the exception of those in kivas and in Room 10 which were of stone, and were found in all rooms, whether on bedrock or midden fill. These floors were easily identified by their smoothness, hardness, and thickness which varied from one to several inches.

FIREPITS

Nothing characteristic was noted in clay floors, except the position of the firepit, which was invariably in a corner, or against the wall 2 or 3 feet from the corner. This position does not apply to kiva

fireplaces, which will be discussed later. Firepits were made with sandstone slabs set below the floor surface and plastered, or by plastering the sides of a hole within the floor itself. Dimensions vary, as shown in the accompanying table (fig. 30).

Firepits

<i>Room</i>	<i>Length</i>	<i>Width</i>	<i>Depth</i>	<i>Sides</i>	<i>Corners</i>	<i>Remarks</i>
R-10	1' —	— 11"	— 8"	3 of Clay 1 of Stone	Slightly rounded	
R-18	1' 2"	1' 2"	?	Clay	Rounded	Against S. E. wall 4' 7 from S. W. wall.
R-19	1' 2"	— 10"	?	Clay	Slightly rounded	In N. W. corner.

FIG. 30.

MEALING BINS

Mealing bins were found in approximately the same position as firepits, *i. e.*, against the walls, but confusion in identity is not likely since firepits are usually lined with clay, contain ashes and extend below the surface of the floor, whereas mealing bins are not lined with clay, contain no ashes, and are built above the floor. In two rooms bins were found in the corner, the walls serving for two sides of the bin, while in one room a bin was constructed against the south-west wall, 4 feet from the nearest corner. All mealing bins found were larger than the firepits (fig. 31).

Mealing Bins

<i>Room</i>	<i>Length</i>	<i>Width</i>	<i>Depth</i>	<i>Below floor</i>	<i>Number sides</i>	<i>Remarks</i>
R-13	1' 10"	1' 3"	1' 4"	— 1"	2	In N. W. corner, two walls serve as sides.
R-19a	1' 9"	1' —	— 9"	No	3	N. E. wall 1' 6" from S. E. wall.
R-22	2' 3"	1' 5"	1' —	No	3	Along S. W. wall about 4" from S. E. wall.
R-11	2' 4"	1' 4"	— 11"	— 1"	2	In S. E. corner two walls serve as sides.

FIG. 31.

CEILINGS

Roof material was found in a number of rooms, but usually in such a poor state of preservation and in such small quantities that

only a faint idea of the ceiling arrangement could be inferred. Rooms 9 and 11 are the exceptions. In Room 9 the ceiling was so perfectly preserved that every step in construction was clearly defined. This room is of average size, which increases the value of the illustration, permitting the use of this roof as a typical example of those for house dwellings. In a north-south direction were two large beams of juniper and piñon of 6 and 4 inches diameter, respectively, supporting a framework of three small poles. These latter, averaging about 3 inches in diameter, were approximately 12 inches apart and were near the middle of the room (fig. 32). Many pieces of split juniper were placed between the east-west cross-poles, thus forming a ceiling upon which brush or grass was laid. The roof was finished with a layer of adobe. Beam holes in the walls naturally vary in size according to the diameter of the beams used. Only the beams were imbedded in adobe pockets in the walls, the split juniper sticks extending to the wall surface. From the beams to the room floor was 4 feet 4 inches; or, if one includes the diameter of the main beams, the ceiling height would be 4 feet 10 inches. As there was no door through the walls, the entrance must have been through the roof at the east end, the only side not covered by the roof when excavated.

The ceiling of Room 11 was largely destroyed by fallen rocks, but fully one-third remained in such excellent condition that comparison with the roof in Room 9 revealed the same kinds of material and same method of construction.

KIVA R-4

The best preserved kiva we found at Kokopnyama is indicated on the map as R-4, and may be seen in plan on figure 33. The kiva is built facing southeast on a sandstone ledge just below the mesa rim. There was little or no soil on the ledge, but the section was once covered by earlier house structures, the tumbled walls of which were sufficiently deep to favor the building of a kiva. This location is similar to that of many present-day Hopi kivas, and is in keeping with the current Hopi custom of building their ceremonial chambers on a lower ledge, if sufficient depth of soil cannot be found on the ground level.

Three sides of kiva R-4 were covered either by abandoned rooms or household debris but the fourth was exposed, being built on the edge of the ledge. The greater part of the southeast wall had weathered away but the remaining portion of the platform was easily recognized and provided a starting point for excavating the kiva. Above its fallen roof the chamber was filled with fallen masonry through which were occasionally found potsherds of Jeddito black-on-yellow and

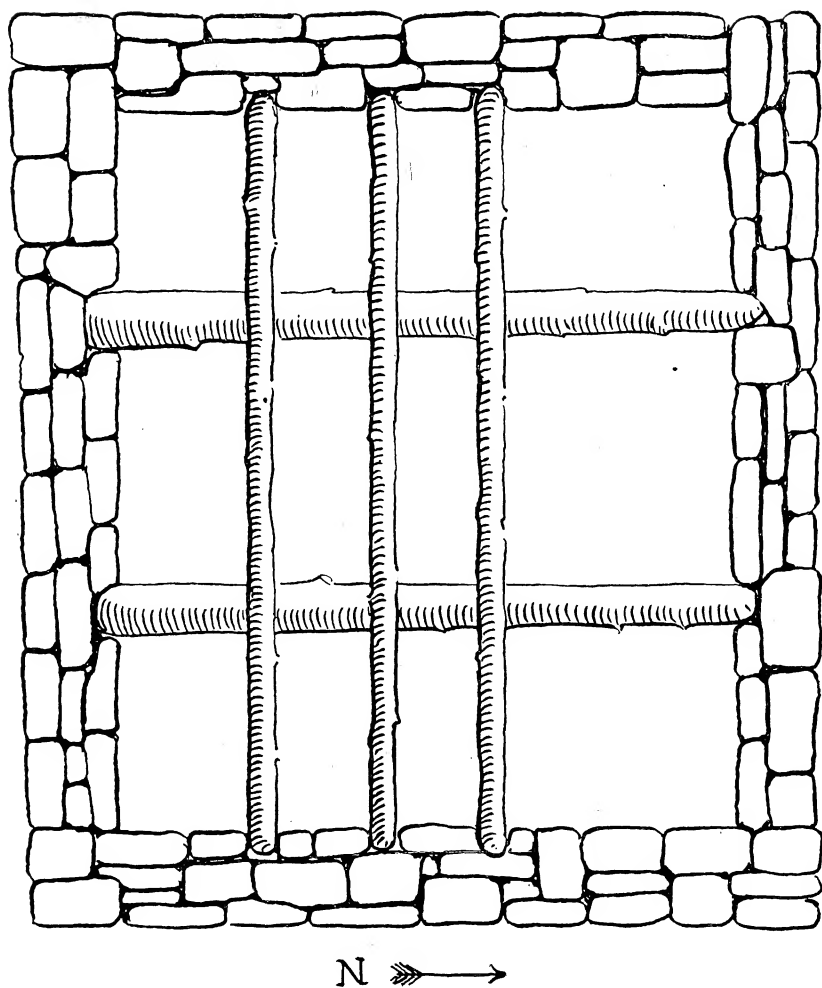


FIG. 32.—Diagram of roof structure in R-9.

Sikyatki polychrome. There is no reason to believe that the kiva became a refuse dump after it ceased to serve for ceremonial purposes since the sherds were too few and scattered, and were not always associated with ash deposits. It is believed these sherds were included in the roofing clay.

That the kiva was used after it was abandoned for ceremonial purposes, however, is clear, for the rear had been made into a small dwelling or storage room, by building in a cross wall, partitioning an area approximately 10 by 6 feet. The floor of this small room was 5 feet above that of the kiva and was made by leveling the accumulations of fallen wall masonry that lay beneath it. The northwest and southwest walls of the kiva were utilized in the smaller room, though an auxiliary wall was built against and parallel to the northwest side. These later walls were of inferior construction and were built of irregular sandstone blocks, chinked with smaller pieces of the same material set in thick clay mortar.

All walls of the kiva were of roughly shaped sandstone blocks averaging about 4 by 10 inches, and were set in thick mortar as in the walls of dwelling rooms, which only differed from kiva walls in that they were thinner and built of smaller stones. The kiva walls were heavily plastered, there being 32 coats on the northeast wall, the 29th of which was red. In the northwest wall, 4 feet 9 inches from the northeast side and 3 feet 7 inches above the floor, was a badly decayed wooden peg set in a hole approximately $2\frac{1}{2}$ inches in diameter. In the southwest wall and near each end, had once been two more pegs of about the same size and distance from the floor as that noted. Only small pieces of the decayed wood were found in these holes. It is presumed that these pegs were for hanging ceremonial paraphernalia or other objects, as in modern Hopi kivas.

Originally, the kiva was much larger than at the time of abandonment. On two separate occasions its dimensions were reduced by strengthening walls (fig. 33). The original dimensions of the kiva room, exclusive of the platform, were approximately 14 feet 6 inches, by $11\frac{1}{2}$ feet. The back of the kiva, or the northwest wall, originally was the plastered face of a midden, in which the kiva had been partly excavated, and apparently served for several years since it was plastered four times. That the "midden wall" weakened is indicated by a slight bow in the middle, which was strengthened by building against it a masonry wall about 8 inches in thickness which was in turn further strengthened by a second masonry wall constructed at a point 3 feet 5 inches from the "midden wall," and ingeniously arranged with a

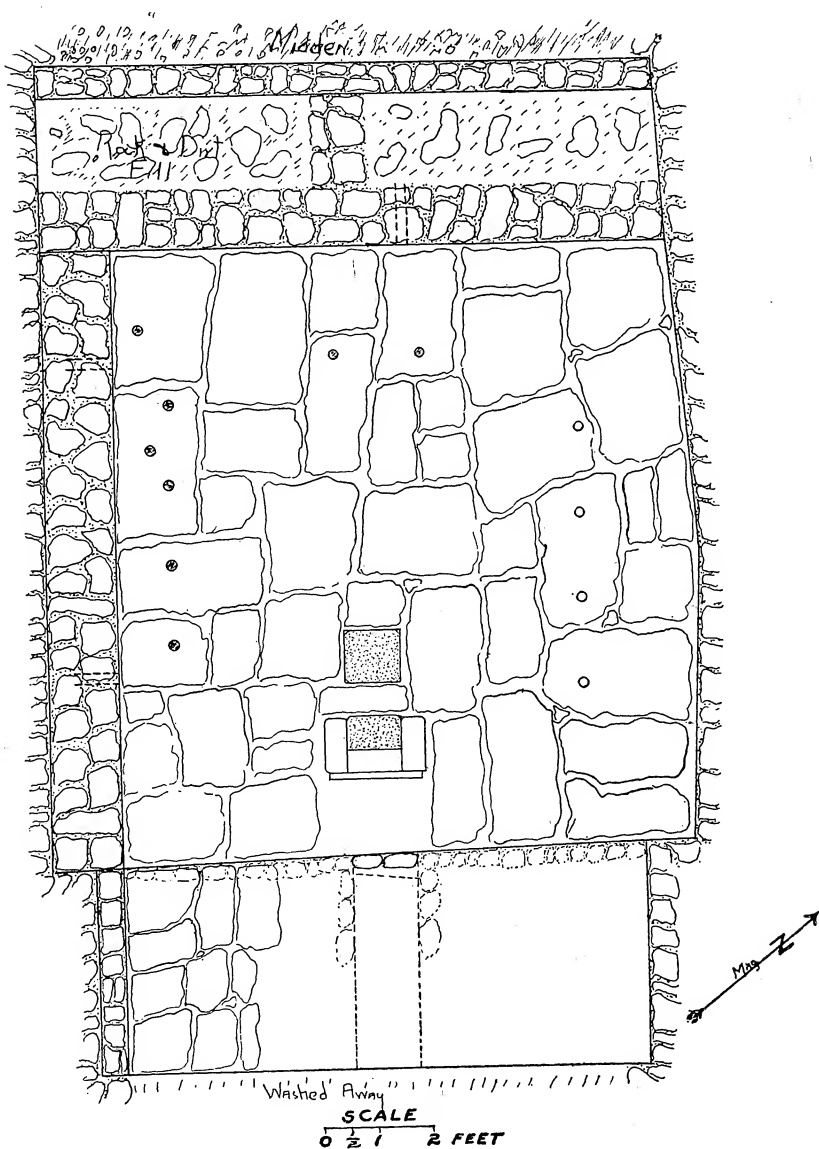


FIG. 33.—Plan of Kiva R-4.

When first constructed, the rear wall of R-4 was the plastered face of a refuse heap, like KT-J at Kin Tiel, and threatened another disaster which was timely averted by an ingeniously arranged brace wall. No datable beam material was collected.

brace wall of stone between it and the first masonry wall, the intervening space being filled with loose rocks and earth (fig. 33 and pl. 23, fig. 1). This was the northwest wall of the kiva when it was abandoned. Under the plaster coats, of which there were several, and imbedded in the mortar of the wall were two sherds of Jeddito yellow ware. One of these was an undecorated surface, while the other was an excellent example of Jeddito black-on-yellow. The northwest wall showed no further evidence of weakening, but the southwest wall eventually weakened, and was reinforced by building another masonry wall against it. The new southwest wall is 20 inches thick and wider than the offset on the southwest side by 5 inches.

A comparison of the various sizes of the kiva at different periods of remodeling may be made from figure 33. On the northeast side the offset is 11 inches. After the construction of the new wall on the southwest side there remained only the offset on the northeast, but by removing some of the masonry of the new wall the original size of the offset on the southwest side was found to be 15 inches. Originally the platform was 9 feet 10 inches long, but this length was reduced 5 inches by extending the extra width of the auxiliary southwest wall across the end. The platform is 3 feet 10 inches wide, and its floor is 21 inches above the floor of the kiva room. Though the southeast wall is missing to the level of the platform floor, the platform walls and face are of similar material and construction to the walls of the kiva room. The kiva, being on a ledge below the mesa top and surrounded on three sides by tumbled walls, was constantly subject to erosion from the slope above. As a result of this action the southeast ends of the kiva walls were reduced on the sides of the platform to only a foot or two high, and the southeast wall was reduced to the top of the platform. At the top of the wall in the northwest corner were two layers of masonry extending for several inches over the plastered wall of the midden excavation, and since the depth of the kiva at this point is 8 feet 4 inches, it is probable that this represents the original height of the kiva. The height of the kiva at the northwest corner of the present end wall is 7 feet 8 inches, but the weathered slope of the walls from beyond this point to the southeast wall indicates that the original height of the kiva was greater.

The floor was covered with flagstones of varying sizes, with the exception of the space between the ventilator entrance and the deflector, which was of hard packed rock and earth. As noted in the kivas at Kin Tiel, this space represents the hole dug in setting up

the deflector. About 6 inches below the level of the kiva floor in the earth and rocks, was found a Jeddito black-on-yellow sherd. The platform also was originally paved with flagstones but several were removed by our Indian workmen before the error was discovered. The only flagstones now remaining on the platform are at the southeast end. On the floor of the kiva, 2 feet from the northeast wall and 3 feet from the base of the platform, is a line of four holes with an average diameter of 2 inches, which are 19 inches from center to center. The belief that these holes were used in weaving is supported by finding two "loom blocks" in the kiva (pl. 23, fig. 1). These blocks are of sandstone and are about $11\frac{1}{2}$ inches long, 8 inches wide, and $6\frac{1}{2}$ inches thick. Sandstone blocks similar to these, but longer, and with hand holds pecked in each end are found in modern Hopi kivas where their uses also vary. At the present time so little weaving is done that they are used primarily for seats. On the southwest side is another line of four holes, 4 feet 1 inch from the platform, and 1 foot from the southwest wall. These holes are slightly larger than those on the northeast side, being $2\frac{1}{2}$ inches in diameter, and are 18 inches from center to center. All holes on the southwest side were plugged with clay, which may be accounted for by their nearness to the southwest wall which was constructed after the kiva floor had been laid. Two other holes on the same side, and near the holes in line, were also plugged with clay, indicating that when the kiva was abandoned none of the holes on this side were being used. In the rear of the kiva and parallel to the northwest wall were two more holes, 2 inches in diameter, that were likewise plugged with clay. The position of these holes—2 feet from the northwest wall and almost in line with the firepit and deflector—made it appear that one of them might have been the sipapu, but this could not be definitely determined.

The deflector is a sandstone slab $1\frac{1}{2}$ inches thick, 20 inches wide, and standing 16 inches above the floor. The top was rounded into an arc. Seventeen inches from the ventilator entrance, the deflector was set 9 inches into the floor. An interesting feature of the deflector is its relation to a firepit of which it was part. At each side of the deflector was built an arm of sandstone and adobe that extended at right angles to the deflector, the whole resembling an arm-chair without legs (pl. 23, fig. 2). Each arm is 12 inches long, 5 inches wide, and 7 inches high. Between the arms is a peculiar firepit—peculiar in that it has two floor levels, the first level with the floor, the bottom being a sandstone slab, the two arms and the deflector serving for three sides; the fourth side is open. Five inches from

the deflector and parallel with it is a pit 12 inches long, $7\frac{1}{2}$ inches wide, and 10 inches deep, the bottom of which forms the second level of the firepit. This deeper part is filled with ashes, but its exact function is not known.

A second firepit $6\frac{1}{2}$ inches from the one described (pls. 23, fig. 2, and 24, fig. 1) is 12 inches square and 13 inches deep. There is nothing unusual about this pit, which was clay lined with hand rounded corners, and in line with the first firepit, the deflector, and ventilator. Like the first firepit it was fitted with a sandstone cover, and was filled with wood ashes. The top is level with the floor.

Near the center of the platform is the entrance to the ventilator, which is 14 inches square. Over the top, and sustaining the weight of the platform floor is a lintel of sandstone slabs set in mortar. The bottom of the lintel is a single slab, upon which are two shorter slabs, placed end to end. From the platform to the bottom of the lintel is 7 inches. The length of the passageway is not known since it is partly eroded near the southeast wall; it probably extended through the platform as in the kivas at Kin Tiel. The length of the part remaining is 3 feet 2 inches. For 7 inches back from the entrance, the floor of the passageway is formed of a sandstone slab; but at a point 5 inches from the entrance there is an upright slab 11 inches high, behind which were found several lumps of red paint, two manos covered with paint, two hammerstones, half of a Jeddito yellow bowl containing fragments of small bones, and a piece of chert, all of which were on the sandstone floor which extended about 6 inches beyond the upright slab. Covering these artifacts and reaching to the top of the upright slab was an unsmoothed floor of clay that gradually sloped upward and back to the end of the passageway. Between the level of the upright slab and the roof of the passageway was a distance of 6 inches. Though it could not be definitely determined that the upright slab with the clay behind it was a step reducing the height of the passageway, as found in the kivas at Kin Tiel, still there is a remarkable similarity both in principle and execution. The presence of the artifacts behind the slab and beneath the clay floor might, however, indicate that the slab or "step," was at one time farther back in the passageway—at the end of the sandstone floor possibly—if there was an abrupt change in the floor level. Owing to erosion, conditions near the rear of the passageway were unfavorable for accurate notations. The floor of the platform was broken over the passageway by the fallen roof of the kiva, but enough of the passageway roof remained intact to show the order of construction, which was

and made into a vegetable cellar. Another room in the south end was excavated and converted into a cistern from which the seepage has completely saturated the rooms to the north for 50 or more feet. (See fig. 2.) In addition to all this, the owner of Showlow ruin has been more or less actively engaged the last 25 years in recovering artifacts through diggings of his own. A remarkable collection of pottery and other objects was thus accumulated which has recently been acquired by Gila Pueblo,¹ Globe, Arizona. Needless to say, the ruin has suffered tremendously under the march of our 20th century civilization, but nevertheless, from the few intact rooms opened by us were obtained the charred timbers that definitely joined the two sections of the tree-ring calendar and extended it back to A. D. 700.

The ruin is roughly rectangular in shape, the longest axis running north and south. Our excavations did not verify Bandelier's description of a two-unit pueblo, but instead, as Hough indicated, the structure is continuous. Several tiers of rooms occupy the western side, from which three short salients extend eastward to form an **E**. The intervening spaces thus created were used as plazas, the southernmost one having a large depression. Apparently Bandelier had this in mind when he said there was "one circular estufa." As to the probability of a circular ceremonial chamber in Showlow ruin comments are made later.

Hough mentions the fact that the débris covering the ruin was so thin that a plan was not difficult to make out. A further advantage to him was the fact that only a single modern house existed on the site and very little excavation and leveling had been done. While the general plan of a ruin may be observed from surface indications of walls and contour levels, some doubt must always remain as to precise room arrangement and dimensions until actual excavation has been accomplished. To identify rooms uncovered by us from previously drawn plans,² which were based on superficial examination only, was an impossibility. Hence, it seemed advisable to replot the ruin in rough outline and place thereon all tests and rooms uncovered by us and to show their relation to the present superimposed dwellings. (See fig. 2.)

In pursuing the search for charcoal it seemed most advantageous to put down test-pits which could be abandoned if old diggings or rooms unproductive of charcoal were encountered. Frequently the shovel

¹ Mr. Gladwin, Director, has kindly permitted us to examine the collection and to utilize any data obtained therefrom in the preparation of this report.

² Bandelier, A. F., 1892, pl. 1, fig. 38; Hough, Walter, 1903, pl. 21.

the same as that noted in the kivas at Kin Tiel, namely, a layer of small sticks across the passageway covered by a thick layer of adobe. In order to examine the interior of the passageway, however, it was necessary to remove the broken floor, but after completing the investigations the floor was replaced and the eroded section of the platform rebuilt. In addition to this repair the walls were strengthened by replacing with cement part of the adobe mortar between the blocks. Pressure from *débris* against the outside of the wall was partly relieved by removing much of the material, and drainage was provided by trenching around the sides. No provision was made to drain the interior of the kiva, since a crack in the bottom of the pit by the deflector was thought to be large enough to carry off rainwater. It is planned to make more permanent repairs at a later date.

A number of beam specimens were collected, but since the kiva was not burned and conditions were unfavorable for preservation, they were too badly decayed to give a comprehensive idea of the roof construction. All specimens were either piñon, juniper, or cottonwood, and at the time of writing none of the specimens has been dated.

KIVA R-27

The northeast wall of Kiva R-4 was the southwest wall of another room, R-27, which when partly opened proved to be another kiva. Due to lack of time this latter was not completely excavated, though sufficient material was removed to reveal the deflector and edge of the platform.

KIVA R-24

Previous to the discovery of Kiva R-27, another kiva, R-24, was opened and studied (pl. 25, fig. 1). Both R-24 and R-27 are on the sandstone ledge with R-4, and all face in the same general direction. As was shown in the case of R-4, kivas on the ledge are most susceptible to erosion at the southeast end, so it was not surprising to find that only the face of the platform remained intact. The weathering of the slope had reduced the walls at the edge of the platform to 15 inches in the northeast corner, and 2 feet 6 inches in the southeast. Though complete notes could not be taken at this end of the kiva, the ventilator passageway remaining showed evidence of having been roofed with sticks and adobe, while the entrance to the ventilator was covered with a sandstone lintel.

Walls were of the same material and construction as those in R-4, and were heavily coated with plaster, being about $1\frac{1}{2}$ inches thick.

The northeast wall was 10 feet 4 inches long as contrasted to 11 feet 2 inches for the southwest wall. The same lack of consistency was found in the length of the northwest wall and the corresponding width of the kiva between the walls of the platform face. The height of the kiva could not be determined, though those corners with less evidence of erosion are the northwest and southwest, which are 6 feet 10 inches, and 6 feet 2 inches respectively from the kiva floor to the top of the remaining walls. The vertical side of the platform is of masonry and extends to the side walls, but on account of the weathered condition it could not be determined whether there were offsets between the platform and walls.

In the northwest wall are two plaster-lined caches. The first of these is 7 inches from the northwest corner, and on the same level as the base of the cache and floor of the kiva. The height of the cache from the floor to the middle of the top, which is an arc, is 2 feet 7 inches. The depths and widths at the top and bottom differ. The bottom is 18 inches wide, the top 11 inches at the floor level, the depth 15 inches, while the top is oval and slopes downward toward the rear and base of the cache. An unusual arrangement in this cache is a shelf, 17 inches above the floor, composed of three cross sticks of split juniper about 1 inch in diameter upon which rest two sandstone slabs, one upon the other, the thickness of the shelf being about 3 inches. On the floor of the cache was found a large piece of gypsum. The second cache is at the opposite end of the northwest wall, 2 feet 10 inches from the southwest corner. It is D-shaped with the flat side at the bottom, which is 8 inches above the floor of the kiva. The cache is 6 inches wide, 5 inches high, and 8 inches deep. Within the cache was a quantity of red paint.

The floor of the kiva was paved with sandstone slabs, except between the deflector and the ventilator, where it was of clay; many of the flagstones were smeared with red paint. The writer has never heard of kiva floors being painted, and from the quantity of red paint found in the cache, he leans to the belief that possibly the sandstone flags of the floor were used for powdering the lump paint. Along the northeast side of the floor, and 18 inches from the northeast wall, was found the usual line of holes drilled into the stones of the floor. These holes were four in number, each with a diameter of $2\frac{1}{2}$ inches, and averaging 17 inches from center to center. On the southwest side was another line, also of four holes, 1 foot 3 inches from the southwest wall; 1 foot 5 inches from center to center; and averaging 2 inches in diameter. These holes on the southwest side were

plugged with clay, as were also two other holes between the first hole of the line and the firepit (fig. 34). The firepit might be said to be in line with the deflector and ventilator, though it does not "center" as in other kivas, the northeast side of the pit being almost in line with the northeast edge of the deflector. The firepit is 4 feet from the northeast wall and 18 inches from the deflector; is 10 inches square with slightly rounded corners, and 18 inches deep. It was filled with wood ashes. Over the top was a sandstone cover 1 foot square. The deflector was 18 inches from the ventilator entrance, or midway between the ventilator and firepit. As in other kivas described from this ruin, the deflector was a sandstone slab set firmly into the floor. There was a decided lean toward the platform, however, which might have been caused by the falling roof. The deflector was 1 inch thick, 21 inches long, and 18 inches from the floor to the top. The corners were rounded. On the northeast side of the deflector was a loom block, while another was found near the southwest corner of the room. Beneath the fallen roof and scattered on the floor near the deflector and firepit were fragments of Jeddito black-on-yellow and Jeddito corrugated ware.

In the southeast corner of the room and buried beneath the floor was found a cache of two Jeddito black-on-yellow ollas. Both were filled with a coarse sand identical to sand found on ant-hills of the region. Inquiry among the Hopi, however, failed to verify the belief that sand from ant-hills was used for ceremonial purposes, as the discovery seemed to indicate. Both ollas were neatly protected by a sandstone cover beneath the flagstones of the floor.

KIVA R-23

It will be noted that all kivas heretofore described in this paper have been of the Hopi type, and the consistency in plan and orientation would lead one to expect all other kivas of the same period and region to be of the same arrangement. This was found not to be the case, however, for on excavating the room northeast of R-24, a kiva was disclosed that differed greatly in several details. This kiva, R-23 is rectangular (fig. 35), faces north, and has no platform, all of which are radical changes; other departures from the usual arrangement will be noted in order. The material and construction of the walls is essentially the same as others described and the floor was paved with flagstones. This kiva, also located on the sandstone ledge below the mesa top, is therefore subject to erosion, and on account of the orientation, the southeast side was affected more than that in the other two

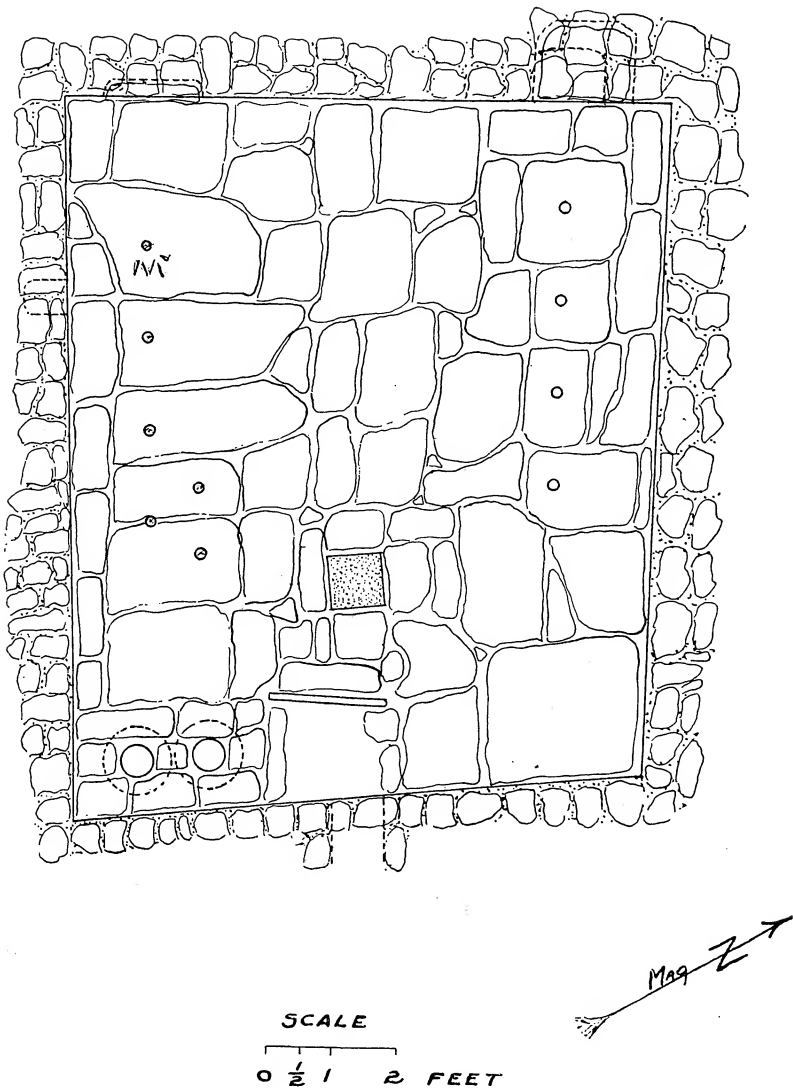


FIG. 34.—Plan of Kiva R-24.

Beneath the floor of R-24 were found two Jeddito black-on-yellow jars filled with coarse sand which was probably reserved for ceremonial purposes. In the rear wall were two caches which are said by the Hopi to have been used in the Bean Ceremony. Kiva R-24 was constructed in 1380 A. D.

kivas, resulting in the complete destruction of the southeast wall and part of the flooring on that side. The northeast and southwest walls were also partly destroyed at the southeast ends, so that complete measurements could not be taken. The remaining portions of these two walls are 8 feet 2 inches, and 7 feet 10 inches respectively. The northwest is complete, though badly bowed from the weight of the débris on the outside, and is 10 feet 3 inches long. With the tops of the walls weathered, the ceiling height of the kiva could not be determined, though it is known to have been more than 4 feet 9 inches as determined from the present height of the walls in the northwest corner. In the northwest wall, 3 feet 6 inches from the northwest corner of the room, is a D-shaped cache 2 feet high, 1 inch above the floor. The cache is 7 inches wide, 6 inches high, and 5 inches deep. In the floor of the kiva, 3 feet 6 inches from the northeast wall, 1 foot 3 inches from, and parallel to the northeast wall, are four clay-plugged holes, 2 inches in diameter, and averaging 1 foot 5 inches from center to center. Three feet 9 inches from the northwest wall, and 3 feet 8 inches from the northeast wall is the sandstone deflector, $1\frac{1}{2}$ inches thick, and 18 inches wide. The height of the deflector is not known since the deflector was broken off 9 inches above the floor, nor could the missing top be found.

One foot 7 inches from the deflector and near the center of the kiva is a firepit of plastered sandstone slabs, with slightly rounded corners (pl. 26, fig. 1). The northwest side of the pit is 10 inches long, the northeast side is 12 inches; the other two sides correspond in length to their opposites. The depth is 21 inches. Between the deflector and the northeast wall is another firepit which lacks the regularity of the former. The southeast corner of the pit is 6 inches from the deflector as contrasted with 3 inches from the southwest. A better idea of the shape and position may be gained by referring to figure 35. The dimensions are 17 inches for the southwest side, 11 inches for the northeast, 12 inches for the northwest, and 10 inches for the southeast. The sides are of sandstone slabs, plastered and with slightly rounded corners. For a depth of 6 inches from the top of the pits, and level with the floor of the kiva, was wind-blown sand under which were ashes. Lying on top of the wind-blown sand in the second firepit were Jeddito black-on-yellow and Sikyatki polychrome sherds.

The ventilator is not as truly aligned with the deflector or firepit as in R-4 and R-24, nor does it conform specifically with other ventilators examined in Hopi type kivas. The entrance to the ventilator is in the face of the northeast wall 3 feet 6 inches from the northwest wall, and was originally 8 inches wide but has been reduced in width by partly filling the opening with clay. It is 9 inches high, 5 inches

deep, and is roofed with sticks covered with clay. The base of the entrance and passageway is level with the kiva floor, and is of clay (pl. 26). This short passageway—if it may be so termed—is built into the masonry wall of the kiva and connects with a circular airshaft 6 inches in diameter that extends upward at right angles to the passageway. The airshaft is a hole running vertically through the middle of the wall from the ventilator passageway to the remaining top of the wall, which is 3 feet above the floor of the kiva. The airshaft is strik-

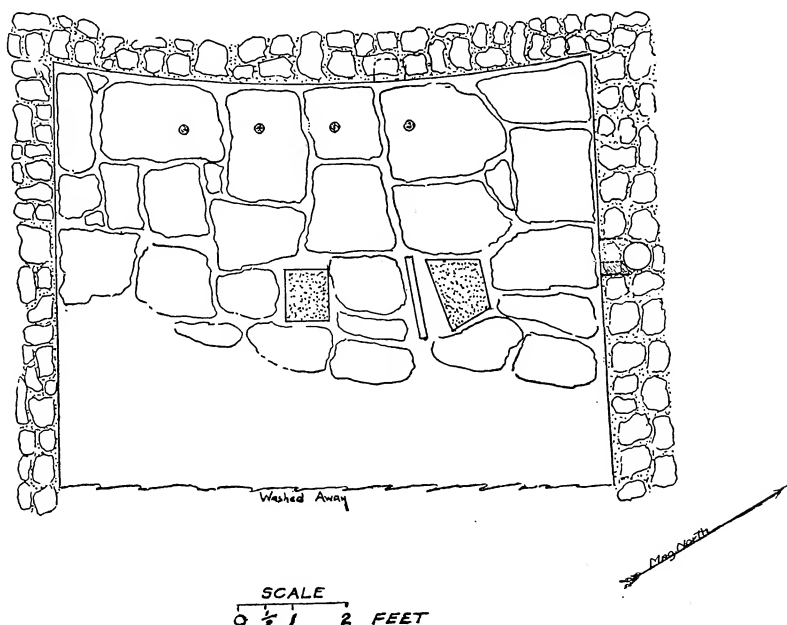


FIG. 35.—Plan of Kiva R-23.

Kiva R-23 is the only kiva excavated in which the ventilator is on the north side. In this instance the entire passageway and airshaft are within the north wall. From among the coals in the firepit a datable specimen gives the year 1416 A. D.

ingly like an ordinary flue. In a small midden-fill on top of the roof clay were sherds of Jeddito black-on-yellow and Sikyatki polychrome.

Further investigations of conditions concerning this kiva might determine it to be the rear of an abandoned kiva remodeled for ceremonial purposes, or another type of kiva used contemporaneously with the Hopi type. It is possible that the northeast and southwest walls can be followed along their bases for a sufficient distance to settle this question. It should be remembered, however, that the principal object of our limited excavations was search for beam speci-

mens, so the writer could not always investigate conditions as thoroughly as he would have liked.

BEAM SPECIMENS

As has been previously stated, the primary objective of the expedition was to secure datable beam material. With this in mind Kokopnyama was examined in 1928 and, though the site proved prolific in the desired pottery types, little hope was felt for the discovery of pine timbers, since the predominating woods today are juniper and pinyon. Our activities were, therefore, directed to Showlow where pine trees were still growing within a short distance of the ruin, and where previous examination had revealed that the ruin was destroyed by fire and pine charcoal was abundant.

After the memorable discovery of HH-39, which "bridged the gap," my attention was directed to the less favorable Hopi country in hope of substantiating the Showlow results from a widely separated district. The chance was admittedly slim since the mesas are devoid of pine, but having previously discovered several datable specimens from Kawaioku, a pueblo of later date, some slight encouragement was gained, and it was hoped that the earlier pueblo of Kokopnyama might fulfill our needs. At this time Doctor Douglass had not recognized pinyon as reliable material, and it was not until much laboratory work had been done by Mr. Haury that Doctor Douglass realized the value of pinyon, and that once familiar with its characters, absolute dates could be determined. This discovery was joyful news to me, for I had begun to feel that my efforts at Kin Tiel and Kokopnyama were wasted, since only a few unfavorable specimens of pine had been found. I had collected a number of pinyon specimens, both of wood and charcoal, and with this latest development, I knew that not only could Kin Tiel and Kokopnyama be dated, but that countless other ruins situated in similar desert regions would eventually give up their secrets.

Unlike the Showlow ruin, Kokopnyama was not burned, which further lessened our chances, since the preservation of wood is dependent upon many factors that are rarely encountered in the proper combination. To date 42 specimens from Kokopnyama have been dated, 20 of which are charcoal, among which was only one pine specimen. The remaining 22 wood specimens were all from dwelling or storage rooms and gave the following dates: 1380, 1430, 1383, and 1389; two of 1369, four of 1370, and one of 1399; three of 1400, and one of 1416; one of 1400; one of 1255; one of 1371; and two of 1269. These dates are grouped according to their association.

With the exception of one specimen of charcoal found in a refuse heap and which was dated in 1928¹ all others were from kivas. Kiva R-24 was the only one in which dated roof beams were found. Seventeen of these dated 1380, two others giving the years 1362 and 1368 respectively. The great number of specimens dating 1380 A. D. would indicate that the kiva was either constructed in that or the following year. The remaining charcoal specimen was found in the firepit of Kiva R-23 and dated 1416, proving that the kiva was in use after that year. Many specimens from Kokopnyama still remain to be dated.

POTTERY CHRONOLOGY

Though several expeditions were made to the Hopi country in the latter part of the 19th century, it was not until 1917 that an effort was made through correlation, and stratigraphic and statistical methods to work out a chronological sequence of pottery development for the Little Colorado area, which includes the Hopi country. This work was undertaken by Spier,² of the American Museum of Natural History, whose principal object was a determination of the Zuñi series. The occurrence of Hopi pottery was lumped under the term "Buff-ware," which term was applied to Hopi as well as Zuñi wares. Thus, the Hopi sequence remained unsolved, and it was Kidder in 1923 and 1926 who first threw light upon the subject. As a result of a survey of a number of ruins, from surface examination and stratigraphic investigation he was able to determine that a yellow ware with black decoration preceded the Sikyatki polychrome which was in use at the Hopi pueblos when the Spaniards arrived in 1540.

This was the condition of affairs in the spring and summer of 1928 when the writer made a survey for Dr. A. E. Douglass in the interest of the Second National Geographic Society Beam Expedition, in an effort to determine those sites occupied or abandoned during the period known in the Douglass tree-ring chronology as the "Gap," a period which covered the time between late black-on-white wares and the development of early historic pottery types.

Briefly, the result of the 1928 study of Hopi pottery was the establishment of a pottery sequence for Pueblo IV in the Hopi country,

¹ Douglass, Andrew Ellicott, The secret of the Southwest solved by talkative tree rings. *Nat. Geogr. Mag.*, Dec., 1929.

² An outline for a chronology of Zuñi ruins. *Anthrop. Papers, Amer. Mus. Nat. Hist.*, Vol. XVIII, pt. 3, New York, 1917.

which substantiated the order suspected by Dr. Kidder. This sequence has withstood the test of stratigraphy, and has been verified by dates from beams found at Kawaioku in close association with pottery specimens representing the different periods. This development is not clearly understood as yet, and will be presented at some future time after the study of pottery specimens collected has been completed. The tentative classification used in field research is based upon the order in which characteristic pottery types first appear, and though the order of development has been verified, the periods as designated may later be revised. In the following classification only the type specimen for each division will be given. The classification is as follows:

- Pueblo III (Basic complex): Kayenta black-on-white and Kayenta polychrome.
Pueblo IV, Period A : Jeddito black-on-orange
Pueblo IV, Period B : Jeddito black-on-yellow
Pueblo IV, Period C : Sikyatki polychrome

In an effort to help clarify the matter of Southwestern terminology, names of ceramic types follow the recommendations of the 1927 Pecos Conference. They are binomial—a geographic locality followed by a descriptive term. Generally speaking the type specimens of Pueblo III and Pueblo IV of the Hopi region are easily described; specifically, they are difficult of description. Pueblo III at the present time embraces the types found at Betatakin and Keet Seel, as described by Kidder,¹ and others. Though it is reasonable to expect further divisions of Pueblo III in the Hopi country, our knowledge is not yet sufficient to designate any one type as representative of a definite division, so we are necessarily forced to classify the period by its ceramic development. Period A of Pueblo IV is different, however; it is characterized by a ware of a peculiar shade of orange, sometimes ranging from almost red to a near-brown, which is decorated with black paint and has sherd temper. This is Jeddito black-on-orange and is found consistently associated either with late black-on-white, an earlier developed ware, or with Jeddito black-on-yellow, the succeeding type. Color alone is not sufficient for the identification of these types, for specimens in peripheral sites often are similar in color though they differ in other details which are recognized by one familiar with either type. Frequently the difference cannot be fully

¹ An introduction to the study of Southwestern Archaeology. A. V. Kidder, Yale Univ. Press, New Haven, 1924.

explained, and is recognized by the "feel" of the ware—a fact noted by all familiar with Pueblo pottery. Sherds of the period types dealt with in this paper are common in ruins belonging to the same cultural development, the difficulty in identification being limited only to peripheral finds. Jeddito black-on-yellow is characterized by the smoothness and quality of the ware, partly depending upon the fineness of the tempering material, which is seldom obvious to the naked eye. The basic color shades vary from cream to rich orange, while the decoration may be from light brown to black. The appearance of this type is sudden, suggesting a radical change in technique or materials—possibly both. A paper dealing with important differences in decorative technique and correlation with dated beams is in preparation.

In addition to normal pottery types as given in the preceding paragraph, occasional intrusive sherds from other regions have been found on the surface of the pueblo and in refuse heaps. Most notable of these are Zuni glaze-paint specimens as noted by Hodge.¹ A sherd of "green glaze on white or creamy slip" (Zuni Chronology, Period C) was found associated with a few Jeddito black-on-yellow sherds mixed with the fallen walls of Kiva R-4. The relation of these sherds to the occupation of the kiva is rather indefinite, though it is felt that they were included in the wall masonry. No specific importance, other than the occurrence of this Zuni type during Pueblo IV can therefore be given. Four-mile polychrome has also been found on the ground surface, but is less common than the Zuni wares. It occurs commonly in Pueblo IV ruins along the Little Colorado River and at Chevelon to the south. Rarely a sherd of Middle Gila pottery is also found.

Though it is not intended to comment upon the various forms of pottery found at Kokopnyama since this subject is worthy of separate note, it is of interest to remark upon the discovery of a problematical form found in a test hole. The vessel is a plate-like object with perforations around the edge. This form is described by Mr. Haury. The Kokopnyama specimen is smaller than that from the White Mountains. It is 7 inches in diameter, has one row of perforations around the edge, and four rows quartering the vessel. Perforations are made from the inside and average $\frac{1}{2}$ inch from center to center. Like the Pinedale specimen, clay was adhering to the inside when discovered. This would strengthen the belief that it was made for a pot rest to sustain the weight of large jars in the making, though no plausible explanation has been given for the perforations. Hopi workmen suggested that it might have been used in an obsolete cere-

¹ Kidder, A. V., *Southwestern archaeology*, p. 91, 1924.



1. Deflector and platform, Kiva KT-I, Kin Tiel.



2. Note shadow of airshaft, Kiva KT-II, Kin Tiel.



1. Showing charred beams in corner of Kiva KT-II,
Kin Tiel.



2. Fallen beams over loom-holes, Kiva KT-II, Kin Tiel.



1. Kiva R-4, Kokopnyama, showing brace wall between rear wall of kiva and first masonry wall.



2. Kiva R-4, Kokopnyama, showing combined deflector and firepit.



1. Kiva R-4, Kokopnyama, with platform restored.



2. Kiva R-4, Kokopnyama, showing covers to firepits.



1. Kiva R-24, Kokopnyama; general view. Note ollas buried in upper right corner of room.



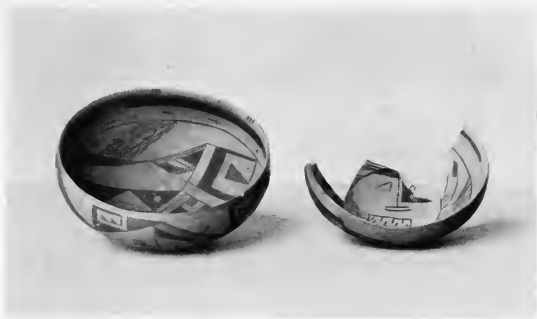
2. Room 11, Kokopnyama; part of fallen roof removed showing buried olla in corner. Note beam hole (top) and cache.



1. Kiva R-23, Kokopnyama; general view of firepits, deflector and ventilator.



2. Room 10, Kokopnyama; firepit behind upright slab in corner.



1. Jeddito black-on-yellow bowls, Kokopnyama.



2. Late black-on-white ware ollas from Kin Tiel.

mony in which vessels of this description were used. It is reported that the perforations were to hold flowers as in a modern flower holder.

Kokopnyama would give little encouragement to a pot hunter, and the paucity of complete or restorable specimens was a blow to the investigators since we had expected a nice collection of these excellent wares as a by-product. Only one room, R-II, contained unbroken vessels, practically all other rooms either being filled with refuse or containing nothing at all. Room R-14 will prove of value, however, since it was filled with refuse containing a great quantity of broken pottery vessels, the majority of which were Jeddito black-on-orange. Associated with these specimens were a few late black-on-white vessels, but none of the later Jeddito black-on-yellow ware was found. This is the only occurrence of the orange ware found at Kokopnyama in which it was not also associated with the yellow ware. Many of these specimens are restorable, and it is expected that much will be learned from a study of them.

SUMMARY

Briefly, the results of the 1929 work at Kokopnyama have contributed to our knowledge of prehistoric Hopi culture, in that:

(1) Details of dwelling rooms have been found similar to those of modern Hopi pueblos, if Spanish and American influence is disregarded;

(2) A knowledge of ceiling construction is gained and found to be essentially the same as in historic Hopi structures;

(3) Three kivas, two completely and one partially excavated, furnished data for comparison with ancestral (at Kin Tiel) and modern Hopi types; thus making it possible to have the evolutionary development from 1276 A. D. (see Kin Tiel) to the present time;

(4) Many beam specimens were acquired which, when dated, will give approximate years for important stages of kiva development, and associated pottery types;

(5) A determination was made of the definite time of decadence of old and rise of new pottery types;

(6) Confirmation was obtained from stratigraphic evidence of prehistoric Hopi pottery sequence as previously determined by other means; and

(7) Much cultural material was acquired.

would bring up from depths of 3 to 6 feet an old rusty horse-shoe, baling wire, a tobacco can or a fragment of a modern glazed dish, all evidences of a former disturbance. During the course of our operations, 16 major tests were made. Some of these extended over a part of a room only, whereas others included as many as three or four adjacent dwellings.¹

We explored, in whole or in part, 29 rooms; of these 22 had been destroyed by fire and consequently contained greater or lesser quantities of the desired charred timbers. All unburned rooms were located in the northeast section of the pueblo which had apparently been abandoned and covered with *débris* while the dwellings to the west were yet occupied. At a time subsequent to the abandonment of the old northeast section it seems that the entire remaining inhabited part of the pueblo was destroyed by fire, for apparently the same fate befell room after room from the extreme north to the extreme south ends. This wholesale burning is very probably an indication of the work of marauders, the domestic utensils and stores of corn found in nearly every room forming additional evidence of the fact that the occupants of the pueblo were forced to a hasty evacuation.

Approximately 1,200 specimens of charcoal were collected at Showlow. A large proportion of these are small fragments of roof timbers, sections of branches, or pieces of split pine from roof members. Large sections of timbers, less frequently found, are the more desirable, since from them the actual cutting dates of the trees may usually be derived. Cutting dates, furthermore, under normal circumstances signify construction dates. This is especially true when several timbers in the same room terminate with the same year. The value of cutting dates will be recognized at once, for they not only provide the actual construction time of given rooms or parts of pueblos, but they also furnish fairly reliable dates concerning the associated artifacts.

To intimate, as we already have, that the true outside of a tree or the first ring beneath the bark indicates the cutting date, may be assuming too much without further explanation. Is it probable that the Pueblo builders used the dead wood in forests in preference to felling living trees?

The present Pueblo Indians, if unable to salvage beams from deserted habitations, go to the forest for fresh timber when this is not furnished by the government. Several years ago in northeastern

¹On the plot of the Showlow ruin, fig. 2, the tests are designated by the letter T and the rooms by the letter R.

Arizona, I observed an Indian bringing in a wagon-load of poles for a new dwelling and all were freshly cut. In ancient times when trees had to be felled with stone axes, the choice of green over dead wood can easily be understood; the seasoning that a dead tree gets considerably increases its resistance against blows of a stone axe.

Doctor Douglass has found that large areas of dead timber, killed by some natural cause, are rare in the Southwest. It is improbable that the ancient Pueblo Indian was accustomed to search for such regions which might be far from his pueblo, or to hunt isolated dead trees in the forest when the more easily cut living trees were available on all sides. That an occasional dead tree was utilized cannot be questioned, but facts derived in the study of timbers from many ruins indicate the common use of trees cut while growing.

Several pieces of charcoal with bark intact were found in Showlow and Pinedale ruins during our excavations. This is a good indication of green wood; as bark on dead trees in the forest soon falls off. On the other hand, it was customary at Pueblo Bonito¹ and undoubtedly in many other pueblos to remove the bark from roofing beams before they were used. Such a custom would readily account for the lack of more bark-covered wood from Showlow and Pinedale.

Where a number of beams in the same room yield the same year of cutting, it is far more plausible to suppose that the trees were cut simultaneously while growing than that they were collected when dead. In the latter event their ring-records would not terminate with the same year, unless gathered in a large area where trees were killed simultaneously. Such regions Doctor Douglass has found to occur but rarely.

On these grounds, we are safe in saying that the final rings in an overwhelming majority of beams from ruins indicate the actual year of cutting.

It would be useless to go into the detail of circumstances under which the numerous fragments of charcoal were found, but of the larger specimens brief record seems desirable.

Five rooms opened in test 11, in the extreme north end of the pueblo (pl. 1, fig. 1), yielded a number of precious beam fragments. Fortunately, this section was undisturbed except for the removal some years previously of the shallow surface soil. Among the wood specimens from room 4 of this test is one bearing the field catalogue number HH-39. It is a beam section 7 inches in diameter and approximately 10 inches long, charred to a point at one end and internally decayed at

¹ Judd, N. M., September, 1925, p. 237.

the other, owing to incomplete burning. It rested near the northwest corner of the room, about a foot below the surface and approximately the same distance above the floor. By slowly working around it in a vertical cut and wrapping the end with string as it was exposed, the specimen was removed and turned over to Doctor Douglass who was present to witness its removal. The initial study which the specimen immediately received brought out its importance and historic value. Its central ring dated A. D. 1237; its outer gave a cutting date at about 1380. The inner rings cross-dated with the last rings of Doctor Douglass' relative chronology; the outer agreed with his modern ring series, extending from 1929 to A. D. 1260.¹ The archeological importance of this particular specimen, therefore, lay in the fact that it definitely and convincingly joined the Douglass modern and pre-historic ring chronologies and thus made possible the absolute dating of this and other pre-Spanish ruins.

From room 4 there were recovered 30 other specimens, mostly small fragments of charred pine, of which 15 have been dated. A majority of these do not give actual cutting dates, but their broken, outer rings end somewhere in the early 14th century. The most recent identifiable year of the pieces giving terminal dates from this room is 1378 which apparently marks the beginning of a short building period in the north end of the pueblo. One specimen, giving a true cutting date of 1279, or approximately 100 years earlier than the other pieces from the room, is probably a fragment of timber salvaged from an abandoned dwelling and re-used. Doctor Douglass has found that such a custom still exists in the Hopi town Oraibi where beams cut as early as the 14th and 15th centuries are in use in present-day dwellings and kivas.

From room 2 of test II (pl. I, fig. 2), a total of 243 pieces of charcoal were obtained. Of these, 110 have been matched into the established calendar; 44 pieces registering cutting dates and 66 near cuttings.² Among the pieces are two beam sections shown *in situ* in plate 2, figures 1 and 2, both giving 1378 as the cutting date. The inverted bowl over the charred timber in plate 2, figure 1, was on the roof of the dwelling when the fire took place. Thirty-one fragments, some possibly parts of the logs pictured, also gave 1378 as the true outside. Eight other pieces dated 1382, and the years 1356, 1369, 1375, and 1381 are represented by one specimen each.

¹ Douglass, A. E., December, 1929, Nat. Geogr. Mag., pp. 766-767.

² On specimens giving near cutting dates the immediate outside has either been worn or broken away.

Rooms 1 and 3 of test 11, yielded 75 fragments of charred pine; those which have been dated give either 1378 or 1380 as the year of cutting.

The number of wood specimens recovered from rooms 1, 2, 3, and 4, test 11, totals 348; of these 106 have been matched into the tree-ring calendar but do not show the true outsides of the logs, while 62 other beam sections record the actual year of cutting. This latter group represents possibly 20 to 25 individual trees, the majority of which were felled either in 1378, 1380, or 1382. It seems permissible, therefore, to assume that the block of rooms in which these dated specimens were found, was erected during the five-year period beginning in 1378. Apparently construction ceased in this section with the year 1382. A few earlier dates, namely, 1175, 1179, 1279, 1282, and 1356 are undoubtedly re-used timbers.

Charcoal fragments from the various rooms of tests 1, 2, 3, and 12 (fig. 2) collectively, show a building period that extended, roughly, from 1360 to 1375. Numerous other pieces fall generally into two previous periods, ending respectively about 1204 and 1272. Unfortunately few of these show terminal dates so that the above years are of relative value only. As is set forth later, this part of the pueblo showed an unmistakable double occupation. While some disturbance of the débris between the two floors was apparent, much of the charcoal coming therefrom dated in the neighborhood of the earlier period suggested. Positive association, however, cannot be claimed, hence 1204 remains only a tentative date for the lower level of occupancy.

Tests 15 and 16, in the southeast quarter of the ruin, disclosed no evidence of superposed dwellings. With but few exceptions, all beams dated from this section were felled in the late 14th century. In a number of pieces from test 15 the final ring is 1383, indicating that the tree was cut sometime during the winter of 1383-4. This is the most recent cutting date found by us at Showlow and probably marks the end of construction in the pueblo.

A comparative study of all dated charcoal specimens verifies an anticipated condition in Showlow ruin, viz., that the last structural additions were made at both extremities of the pueblo, the most recent at the south end. This longitudinal expansion was apparently controlled by the contour of the elevation on which the ruin rests. It seems that maximum lateral expansion was reached first; then a few rooms were added at the north end filling out all available space at the point of the elevation, and the last rooms were appended at the south end, the only direction in which the pueblo could be easily enlarged. If the

same factor entered into the construction of other pueblos, as it unquestionably did, it might be possible to locate the most recently built rooms of a given pueblo by an examination of its periphery with respect to topographical surroundings.

ARCHITECTURAL FEATURES

Inasmuch as building stones have been removed from Showlow ruin for many years and excessive alteration has taken place, it was difficult to tell how much, if any, of the pueblo was originally more than one story in height. The former existence of a two-story structure was noted in but one of several tests; from conversation with Mr. Whipple it was gathered that he rarely encountered two-story remains during the 20-odd years in which he was actively engaged in local excavations. With a few exceptions, therefore, the rooms of Showlow ruin appear to have been only one story in height.

Showlow masonry is not all of the same type, due to the fact that it is not all contemporaneous. It has already been intimated that rooms opened in tests 1, 2, 3, and 12 (pl. 4, fig. 1) evidenced two levels of occupation. A tentative dating of A. D. 1204 has been assigned to the lower horizon; the upper level of occupancy dating about 1375. Walls related to both levels were uncovered. Lower-level masonry, composed of comparatively large, well-selected stones, and usually chinked, is superior in workmanship to upper-level walls which are poorly constructed of ill-chosen building stones.

A study of potsherds from Showlow ruin indicates the possibility of an even older horizon in the northeast part of the pueblo. Walls exposed here were formed by a basal row of large vertical slabs above which small blocks were placed in rude, horizontal courses (pl. 3, fig. 1). Although inferior in composition, this masonry is similar to the lower level type exposed in tests 1, 2, 3, and 12. This relationship, and the greater antiquity suggested by potsherds for the northeast quarter, leaves little doubt as to the early sequence of wall types.

In test 12 was uncovered an exceptionally good section of lower-level wall, 13 feet in length by 5 feet in height. Here large blocks were substituted for the vertical slabs of the lowest course displayed in the northeast section of the ruin. It was then continued upward by alternating layers of large blocks and small spalls (pl. 3, fig. 2). In some cases the spalls were employed primarily in chinking; in others, it is obvious they served to provide a base for the succeeding layer of large stones. The exposed faces of these larger units were dressed by pecking with hammer stones. This type of masonry,

although much inferior in workmanship, is reminiscent of the second type of Pueblo Bonito stonework, described by Judd.¹ That this section of Showlow ruin was abandoned and subsequently reoccupied is shown by the fact that walls of different masonry abut the wall just described on a higher level.

The most noteworthy instance of superposition was found in test 2, room 1. This dwelling measured $9\frac{1}{2}$ by $10\frac{1}{2}$ feet; near its center was the usual slab-lined firebox (pl. 4, fig. 2). In the northern part of the room, a foot below its floor, a second level, with related fireplace, was encountered (pl. 5, fig. 1). Further excavation revealed the fact that the upper firebox was built upon and almost directly above a partly razed, earlier wall (pl. 5, fig. 2; also consult text fig. 3 for ground plan and cross-section of this room). The north and south walls of the upper room did not go below their related floor, but the east and west walls extended to and rested on the lower level.

Since similar evidence of remodeling and re-use of old walls was noted also in neighboring dwellings it may be supposed that this section of the pueblo experienced general desertion between the two occupations. Whether or not the entire village was abandoned could not be learned from our rather limited work. The difference in pottery from the two levels suggests the lapse of a considerable period of time between occupations. For information concerning the actual length of this period, we resort to charcoal. Accepting for the moment the tentative dating of A. D. 1204 for the lower horizon, the difference between this date and 1375, which has been assigned to the upper level, is 171 years. This is only an approximation because of the readily foreseen difficulty of ascribing definite dates to culture horizons. The abandonment, however, provides a convenient break in the continuity of development, thus emphasizing the time element. That the estimated 170-year period is correct, or nearly so, is indicated by the discovery of pottery types at Pinedale which were developed during this time from types present in the lower Showlow level. Timber associations with Pinedale types place them as post-1290. They in turn developed into the dominant forms of the Showlow upper level. In this way, pottery sequence and tree-ring records were found to support each other in their peculiar ways of recording elapsed time.

The masonry of all the upper-level dwellings, which were occupied to the final abandonment of the pueblo, is of nondescript form. Unworked rocks of all sizes were laid down with no attempt whatever

¹ Judd, N. M., March, 1922, p. 326.

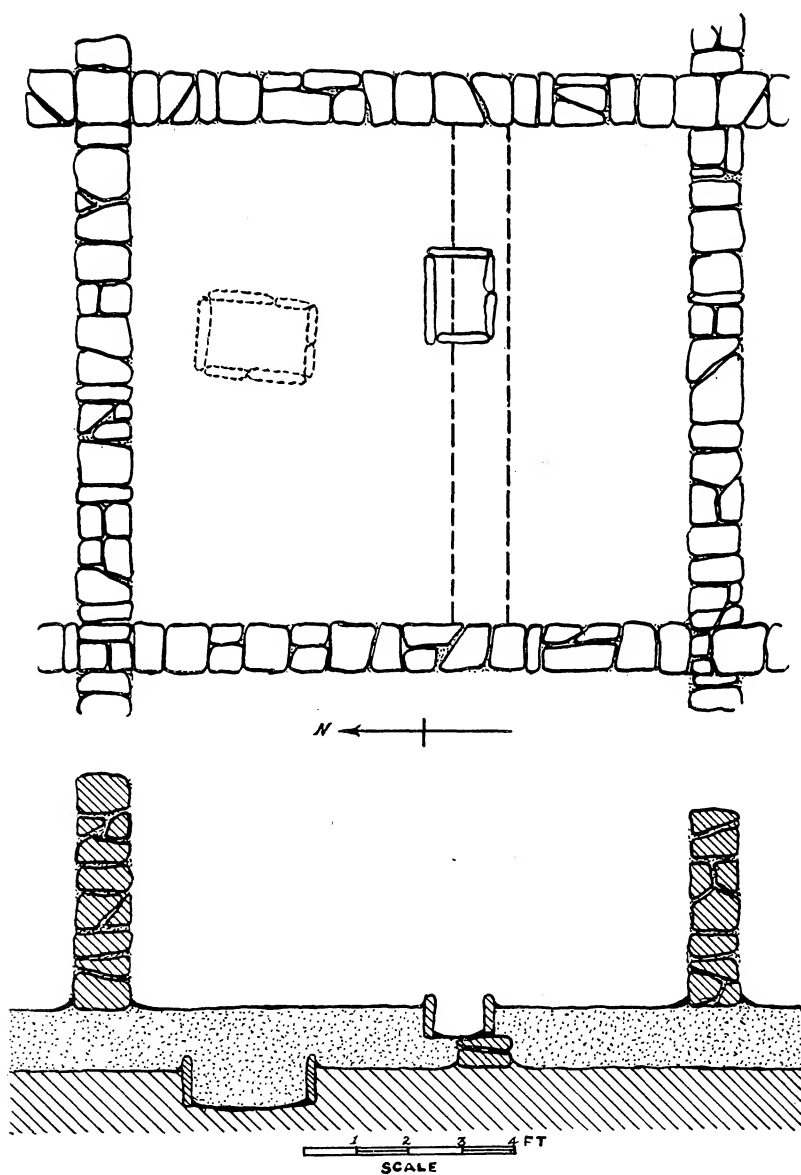


FIG. 3.—Plan and section of room I, test 2.

at coursing. The walls frequently show flat curves or slight offsets, but, whatever their appearance, they were invariably plastered with clay.

The building stone in Showlow ruin is exclusively of buff-colored sandstone of Carboniferous age, broken from out-cropping ledges nearby. In all types of masonry, the walls averaged a foot in thickness¹ and were laid up with an abundance of clay mortar.

The living rooms are approximately square; 11 by 12 feet are measurements frequently recorded. The largest room opened by us was rectangular, measuring 11 by 17 feet. Floors are uniformly of hard packed clay and unbroken except for a slab-lined firebox, about a foot square and 8 or 10 inches deep, located near the center of each room. The rooms apparently were entered through hatchways as no side entrances were found. In several rooms we encountered fragments of large sandstone slabs perforated with a hole large enough to admit the passage of a man. Their position in the fallen roof material suggests that they were used as door frames. In one instance a rounded slab, large enough to close the hatchway, was found in association with the fragments of such a door frame.

Details of roof construction could not be learned with any degree of accuracy since in most cases the charred fragments of ceiling beams were too limited and in an extremely disorderly condition. If we may judge, however, from the impressions in burned roof clay, two methods of covering the principal supporting beams were pursued. In one case, reeds laid at right angles over the main beams formed the filling material, on top of which a final layer of clay was put down. In the second method, pine planks were substituted for the reeds. These planks, roughly split from logs, measure from 4 to 8 inches in width and 1 to 2 inches in thickness.

Kivas were not encountered by us, nor does Mr. Whipple, from our description to him, recall that he uncovered any in the course of his excavations. The depression in the south plaza was apparently judged to be a circular estufa by Bandelier.² An exploratory test in this depression failed to show the flagstone floor which is almost invariably associated with kivas. If, however, this low place actually marks the site of a kiva, in all probability it is rectangular instead of round. All kivas uncovered thus far in late pre-Spanish ruins in this

¹ Bandelier's statement that the walls were 0.20 m. (about 8 inches) thick was probably based on few measurements, as he did not excavate in Showlow ruin.

² Bandelier, A. F., 1892, p. 392.

RECENTLY DATED PUEBLO RUINS IN ARIZONA

By EMIL W. HAURY AND LYNDON L. HARGRAVE

(WITH 27 PLATES)

FOREWORD

In 1921 the National Geographic Society began excavation and study of Pueblo Bonito, a prehistoric ruin in Chaco Canyon, north-western New Mexico. It was the privilege of the undersigned to direct these archeological investigations from their inception to the conclusion of actual field-work in the autumn of 1927.

Pueblo Bonito is unquestionably the finest extant example of that phase of southwestern history known to archeologists as Pueblo III—the period during which small, isolated villages were drawn together into large, complex communities. After a time these communities began to disintegrate; to separate into lesser groups that spread far and wide in search of more fertile fields and freedom from the attacks of nomadic enemies. Then came, in 1540, Coronado and his fellow adventurers to initiate the Spanish conquest of the Southwest; to bring about still further disintegration of the peaceful Pueblo tribes and their unique social organization. This Spanish-dominated phase of Pueblo history, from 1540 to the present, is commonly designated Pueblo V.

In undertaking exploration of Pueblo Bonito, one of our prime desiderata was the determination of a method whereby this famous ruin could be correlated accurately with the recorded history of the Southwest. To be sure, the relative age of the ruin had previously been ascertained through stratigraphic methods and the study of pottery types. It was known to be older than certain ruins; younger than others. Our hope, notwithstanding, was to discover an absolute date—the very year, if possible, during which its prehistoric walls were building.

This desire was finally realized by a novel but altogether convincing method. As I have explained in a short paper published in "Explorations and Field-Work of the Smithsonian Institution in 1929" (*Dating our prehistoric Pueblo ruins*, pp. 167-176, Washington, 1930), Dr. A. E. Douglass, Director of Steward Observatory,

region¹ and also in the Jeddito Valley² have been found to be of rectangular form. The apparent lack of kivas in Showlow ruin need not necessarily imply their entire absence as they may yet be found in several parts of the pueblo which have not been thoroughly examined.

MATERIAL CULTURE

Although the ensuing consideration of cultural material may appear to be a repetition of notes presented some years ago by other investigators, I feel that repetition is justified by the pre-Spanish dates recently fixed for Showlow ruin. By dating the building itself, the artifacts found within it may also be dated.

Foods.—All vegetal products recovered were found in a charred state, obviously preventing accurate and complete description. Practically every room yielded some corn, either shelled or on the cob. Shelled corn was ordinarily stored in large ollas, while ear corn was piled up row upon row, as is the custom of the modern Pueblo Indians. Such piles, when burned, generated a heat so intense as to fuse together large masses of the corn and even vitrify the adobe wall plaster.

Although beans likewise were stored in ollas we encountered them much less frequently than corn. A single small variety, *Phaseolus* sp.³ is represented.

Berry-yielding bushes are found abundantly in this timbered region, especially along the water courses. It was not surprising, therefore, to find among the stores of food stuffs, small quantities of berries. These have been identified as the fruit of the manzanita, *Arctostaphylos pungens*. This berry is about the size of a pea and has a large crenulated seed. The meaty parts are edible either raw or cooked.

Black walnuts (*Juglans major*) were also uncovered. The nuts are small but palatable, and probably were extensively used by the Indians. Walnut thickets still fringe the banks of Showlow Creek and the annual crop of nuts is relished by the children of the neighborhood.

Mammals.—Showlow ruin is located in what was formerly a well stocked game area. Deer and turkeys still range the nearby forests and

¹ A rectangular room with flagstone floor and platform in Four-mile ruin described by Fewkes (1904, pp. 137-138) is apparently a kiva; the Hawikuh kiva (Hodge, F. W., 1922, pp. 9-10), and the kiva uncovered in Pinedale ruin described in this report were rectangular.

² See the chapters on Kokopnyama and Kin Tiel, herein, by Hargrave.

³ For the identification of vegetal products we are indebted to Prof. J. J. Thorner, botanist, Agricultural Experiment Station, University of Arizona, Tucson.

it is only natural that their ancestors should have contributed most generously to the quantity of mammal bones recovered during our excavations. Lower jaw bones of dog, *Canis familiaris*,¹ and Arizona badger, *Taxidia laxus*, were found in room 1 of test 2 and test 13, respectively. Hough reports that he collected "bones of dog, two species of rabbits, turkey, and deer" in Showlow ruin.

OBJECTS OF STONE

Metates.—The milling stones used for grinding maize and other food stuffs are relatively numerous at Showlow. Most of these were manufactured of a porous basaltic lava, but a few were shaped from indurated sandstone. Two types of metates are represented in the collection:

(a) Trough-shaped specimens with both ends open and sometimes worn to a depth of from 4 to 6 inches. These are seldom more than 10 inches wide; their sides are usually carefully shaped by pecking. Without exception these metates were found free in the rooms, *i. e.*, independent of bins. From the position of some in the débris, it was judged they were originally on the house tops.

(b) Flat or slightly concave metates, with grinding surface measuring from 14 to 18 inches long and 10 to 12 inches wide. Mills of this kind are usually found in mealing bins either singly or in series. In room 1, test 3, a set of three contiguous mealing bins was encountered, and Mr. Whipple informed us that he had found during the course of his work as many as five adjacent bins. In a few cases the lower, embedded end of the positioned metate was narrower than the other by several inches.

Manos.—The movable hand stones with which grinding is actually done, are readily classifiable into two broad types, according to the shape of the metate on which they were employed:

(a) *Manos* accompanying the first type of metate described are rectangular in form with rounded corners. They measure from 7 to 10 inches long by 3 to 5 inches wide and are made of igneous rock, rarely of granite or sandstone. Only one surface was used for grinding and this is slightly convex lengthwise of the implement.

(b) *Manos* associated with the second type of metate are characteristic of those usually found in Pueblo IV ruins of northern Arizona. In cross-section they are triangular or nearly so, owing to the double-faceted grinding surface. This distinctive feature is shown by the

¹ Identified in the Department of Biology, U. S. National Museum.

fragmentary specimen in plate 6, figure 1, *a*, which is 8 inches long and 3 inches wide. The mano shown in plate 6, figure 1, *b*, is of the same class but the grinding face is not so pronouncedly angular. Its dimensions are $12\frac{1}{2}$ by 5 inches. The obverse sides of both manos here pictured are rough and unfinished. Their length corresponds to the width of the metates on which they were used. Instead of being made of volcanic rock as are the manos of the first type, these are invariably composed of hard sandstone.

As to the relative time of the above two forms of grinders, we can say that in the northeast quarter and in the lower level of occupation the trough variety only were found, while in rooms dating after about A. D. 1375 both types were coexistent, a greater proportion of the second type being present.

Paint metates.—Still in the category of metates are several specimens of rough volcanic blocks which are unmodified except for a shallow depression in one side. In these hollows the traces of paint materials which were ground in them are still visible. Oval handstones, some also showing color, were no doubt used in these. The basinlike depression suggests a rotary motion instead of one away from and towards the body.

Hammerstones.—These were used for pecking, chipping, and in countless other ways about the home, and are plentiful in Showlow ruin. They vary from small discoidal stones weighing a few ounces to large ones weighing a pound or more, and are usually formed of lava, diorite, or quartzite.

Stone axes.—The stone axes recovered by us were all short-bitted (pl. 6, fig. 1, *c*), none being over 6 inches in length. All, however, were carefully finished and possessed the three-quarter groove or the straight back which is typical of Middle Gila axes. Long-bladed axes of the true Gila type were found by Mr. Whipple.

Polisher.—While this fragmentary specimen (pl. 6, fig. 1, *d*) seems to have been used primarily in polishing arrowshafts, it also suggests other uses. It comes from the northeast quarter of the ruin and is made of a fine-textured basaltic lava, carefully worked even to the smoothing of the sides and ends. Its dimensions are $2\frac{1}{2}$ inches in height from the bottom to the crest of the medial shoulder and $2\frac{3}{4}$ inches in width. The groove to the right of the shoulder was apparently used in finishing arrow shafts but the opposite side does not show this, although it is well worn. A short lateral groove cuts the shoulder 1 inch from the unbroken end. The bottom of the implement also indicates wear.

Polishing pebbles.—Figures *e* and *f*, plate 6, figure 1, show two typical polishing pebbles used in the surfacing of pottery. Both have the very smooth facets which result from long use.

Perforated sandstone plates.—For the two objects represented in plate 6, figure 1, *g* and *h*, we can suggest no definite use. Both are made of sandstone not exceeding $\frac{3}{8}$ inch in thickness; both are carefully smoothed. Figure *g* is $6\frac{1}{8}$ by $5\frac{3}{4}$ inches and has rounded corners as well as trimmed edges. Along one edge there are three perforations, drilled from both sides of the plate. Specimen *h* is rounded, $6\frac{3}{8}$ inches in longest dimension. It has but a single perforation placed $\frac{1}{2}$ inch in from the short straight edge.

These objects are not greatly dissimilar to perforated boiling stones which resemble large pendants frequently found in ancient sites in southern California.¹ Boiling stones of this type are heated in the fire and suspended in vessels containing liquids for cooking purposes. Both of the specimens represented here show the effects of contact with fire, but whether the result from their use or from the burning of the rooms in which they were found, cannot be determined. The custom of using boiling stones, however, is a trait quite foreign to Pueblo culture; hence, their use as such must be questioned.

Loom block.—A single loom block was encountered in one of the living rooms. It is made of a soft friable sandstone and measures about 10 inches in height by 7 inches in width. The base and one side are entirely flat, while the rest of the block is more or less of rounded form. In the flat side near the top is a small depression less than an inch in depth which engaged one end of a stick or rod which formed a part of a loom. Similar objects found in old Hopi² and present-day Hopi kivas are usually shaped into the forms of rectangular blocks with the depressions in one end.

Potter's kneading slab.—A sandstone slab, not unlike those used at Zufi³ at the present time by potters for kneading clay after the ingredients have been ground and mixed, is shown in plate 6, figure 2. It was found with a quantity of raw clay, yellow ochre, and a collection of sherds which had been gathered for pulverization to form tempering material. The slab is rectangular in outline, 33 by 17 inches. Its edges are chipped and pecked to a rough finish and the working surface bears two shallow worn depressions which still show traces of clay.

¹ Handbook of the American Indian, Bull. 30, Bur. Amer. Ethnol., Pt. I, pp. 126-127.

² Hargrave, Lyndon L., p. 108 herein.

³ Guthe, C. E., 1925, footnote p. 20.

Chipped implements.—Relatively few chipped stone objects were recovered. Projectile points are both plain and tanged (see fig. 13 for representative specimens from Pinedale), and a few have serrated edges. Knives and scrapers of chert and obsidian flakes show comparatively little secondary chipping. Figure *i*, plate 6, figure 1, is a chert knife on which the cutting edge has been slightly retouched.

The large implement shown in plate 6, figure 1, *j*, is lanceolate in shape, $7\frac{1}{4}$ inches long and $3\frac{1}{4}$ inches wide. It is crudely chipped from a spall struck from a lava block. Near the center of the object on each edge, are shallow notches which probably aided in hafting it to a handle.

Obsidian cache.—From the northwest corner of room 1, test 15, was taken a cache of 17 obsidian nodules which were probably intended to supply the material for projectile points. The nodules vary from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in diameter. They are somewhat angular and covered with a thin veneer of opalitic substance.

OBJECTS OF BONE AND HORN

Awls.—Specimens *a*, *b*, *c*, and *d*, figure 4, are representative of the bone awls from Showlow ruin. Awls *a* and *d* were split from large bones after longitudinal groovings had been made and then trimmed down, while *b* and *c* were formed of natural bones with little modification. Incising was noted on several awls, probably representing crude attempts at decoration.

Dagger (?).—A large broken implement (fig. 4, *e*) is tentatively identified as a dagger. The fragment shown is 6 inches long with an inch or more broken from each end. A comparison of its size with normal awls makes it quite evident that it was intended to be used in some other way, the most logical use being that of a dagger. In his excavations at Turkey Hill Pueblo, near Flagstaff, Dr. Byron Cummings recovered excellent examples of these. In one instance several were found at the waist of a burial as though they had been suspended from or tucked beneath a girdle. Hodge¹ also pictures quite similar implements from Hawikuh, although he lists them as awls.

Incised bone.—Figure 4, *f* is a section of a mammal leg bone 7 inches long and 1 inch in diameter from which a portion has been severed by a circumambient incision. Below the cut end is another scoring made in preparation for the removal of a short section.

¹ Hodge, F. W., 1920, pls. 10, 11, 12.

Horn implement.—This specimen (fig. 4, *g*) consists of a prong of a deer antler 6 inches in length. It is unaltered except for slight wear at the blunt point and several hackings at the base apparently made with a flint tool in the process of its removal from the major antler.

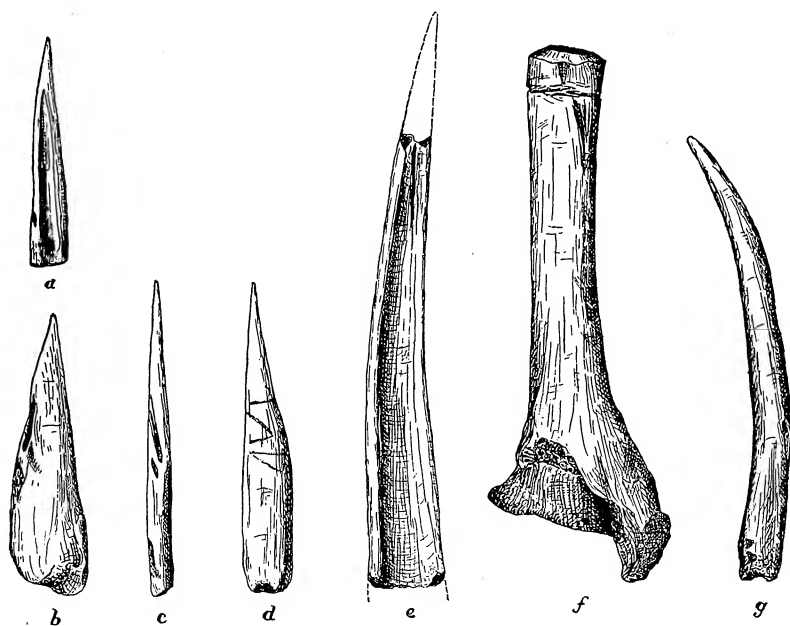


FIG. 4.—Bone tools from Showlow ruin. ($\frac{1}{8}$ actual size.)

POTTERY

The Silver Creek drainage (see map, fig. 1) is a region which in past ages was on the periphery of several important southwestern sub-culture areas. To the north lies the center of Hopi development with its very distinctive yellow decorated pottery; to the east, the old Zuñi pueblos with their variable types of glaze-painted vessels; to the southeast, the Upper Gila; and to the south, the Middle Gila culture areas, each with characteristic pottery. Ceramic types from all of these areas are represented in Showlow ruin. Thus, a treatment of the pottery of a region, especially with reference to its sequential occurrence, where a considerable mixing of local and foreign types has taken place, is a problem of some complexity and one that can be solved only by prolonged and careful research.

Although the limited nature of our excavations does not warrant the drawing of fine distinctions between the several recognized culture

horizons at the present time, the data procured from stratigraphic evidence at Showlow should prove of interest to archeologists. It is also possible here to include some of the invaluable results which have been obtained from the study of tree rings displayed in charcoal. The reliable stratigraphical method of studying prehistory bids fair to be surpassed by this newer means of establishing succession, which embraces the association of artifacts with datable timber. Results obtained from stratigraphy will not only be checked but will be supplemented with the precision that only accurate dates can give. However, precaution must be exercised in its use, for the associated circumstances are of utmost importance. For instance, the finding of newly developed ceramic types in very old rooms, or in rooms where structural timbers were re-used, would be certain to give misleading results unless corroborated by other finds.

At Showlow ruin, the association of pottery with datable charcoal was relied upon to a certain extent in an attempt to establish a sequence. This is true especially of the pottery from the more recently occupied section of the pueblo. In arriving at ceramic correlations between Showlow and Pinedale ruins, charcoal proved to be of invaluable assistance.

Hough¹ observed that potsherds on the surface at Showlow ruin were exceedingly scarce. This reminded him of the practice of modern Zuñi potters, who gather from the rubbish heaps of old ruins sherds for pulverization to be used as tempering material in clays for new vessels. That this practice obtained in more remote times is well known to all students of southwestern prehistory. We found it also at Showlow.

In the corner of room 1, test 12, was encountered a polychrome-on-red bowl filled to the brim with sherds which had apparently been picked up on the trash pile. There is little question but that these had been set aside for future grinding. Almost all types of pottery known at the pueblo up to the time of collection were represented. This has a slight bearing on the technology to which we refer later. Not far from the sherd collection and leaning against the wall was the kneading slab pictured in plate 6, figure 2. The several slight depressions in the working surface were caused by much mixing of ground sherds with clay and the kneading of the paste to obtain the proper consistency. Behind the slab was stored a quantity of raw clay of gray color just as it had been mined, and yellow ochre for use as coloring matter. Worthy of mention too, are several fragments of unfired vessels which were recovered. These clearly show the gray

¹ Hough, Walter, 1903, p. 301.

paste with the admixture of pulverized sherd tempering (see pl. 10, fig. 2). Exterior and interior surfaces of the sherds bore the yellow slip applied in wash form, which, upon firing turns to a rich red. Other tools such as scrapers, formed of broken fragments of pottery, and pebble polishers also show the similarity of ancient and modern methods of making pottery. While styles of decoration and vessel forms are continually undergoing changes, there seems to have been no great departure in method since the close of the 14th century, the approximate age of the objects found.

Two sharply defined levels of occupation were found to exist in the Showlow ruin. All of the rooms opened in tests 1, 2, 3, and 12 had two floor levels (see fig. 3 for plan of room 1, test 2). Pottery types from all lower level rooms were in entire agreement and a correspondence of sherds gathered in upper level rooms was also noted. Comparisons of the sherds from the two levels, however, introduced the fact that there was a considerable difference of time between the two occupations. This difference we have provisionally placed at about 170 years, based upon data derived from datable charcoal.

Lower level types.—Potsherds from the lower level include the following types: Black-on-white, black-on-red, an orange-red ware decorated in both black and white paint, corrugated, and a small amount of intrusive material.

The black-on-white sherds roughly fall into two groups: (a) those showing definite Chaco Canyon affinity, and (b) those obviously related to the black-on-white of the now known Upper Gila culture area. Chaco-like sherds (pl. 7, fig. 1, nos. 1, 2, 3, 4, 5) are fragments of bowls with direct rims having a chalky white slip and rough exteriors. The decoration is in dull black paint and the designs, while they bear certain similarities to Chaco black-on-white, are nevertheless somewhat different. In the hatched elements, for instance, the framing lines are of the same width as the filling lines. The rims, however, are usually painted black and tapered, both typical Chaco features.

Sherds bearing similarities to vessels better known from the south and southeast are preponderantly of ollas and smaller, full-bodied vessels. The paint is dull black, but in rare cases it has a lustrous silvery appearance. The designs (pl. 7, fig. 1, nos. 6, 7, 8, 9, 10, 11, 12) consist of alternating solid and hatched elements, opposed stepped figures and interlocking elements. The canteen and fragmentary bowl, figured in plate 7, figure 2, were found in a firebox in the lower level over which the later occupants had erected a wall. The canteen is

6 inches in horizontal diameter and the orifice formed by a small vertical neck is but $\frac{3}{4}$ inch in diameter. The lugs are squared and the sides of the vessel are depressed immediately below the lugs to allow more space for the passage of a cord. The black paint is dull, applied in an all-over design except for a small circular area at the bottom. The rim is edged with black dots. Canteens of a similar type have also been found on the Gila River in the region of San Carlos and in the Tonto Basin.¹

The bowl is not round but elongated; apparently it was compressed before or during the firing process. Its greatest diameter is 10 inches. The heavy walls terminate in a flattened rim and a slightly over-turned lip. The background is gray rather than a dead white as in the canteen, and the design is in a flat black paint.

The Chaco-like black-on-white ware is most certainly the older of the two black-on-white types from the lower level. The terminal date for Pueblo Bonito given by Doctor Douglass² is A. D. 1127, but it reached its heyday in 1067. Hence, possibly by 1067, certainly before 1127, the Chaco influence was extended southwestward as far as the Silver Creek drainage. Its presence should therefore be expected in sites which antedate the lower Showlow level. That this condition actually exists was clearly demonstrated by Roberts during the summer of 1929 in his work on a pit house and early pueblo site on the old Long H ranch, 20 miles north of St. Johns. He reports³ that the pottery from both the pit houses and the surface pueblo is distinctly related to the Chaco Canyon cultures. In the Showlow lower level, the pottery of Chaco affinity was decidedly on the wane and pottery suggesting Upper Gila influence was springing into prominence. By about 1290, as we found at Pinedale, the former had entirely lapsed and the latter, whose exact relation needs yet to be established, was strongly reflected in the dominant black-on-white ware. In all probability the culture represented by it, first in the lower Showlow level and later more strongly at Pinedale, is subordinate in this region and an extension from the parent stock to the southeast.

Fragments of black-on-red pottery are extremely rare in lower level debris. Rim sherds of a number of individual bowls (fig. 5), however, illustrate the existence of a fairly uniform type. Several of the sherds were found built into the walls of the dwellings of the first occupation. This may signify that a still older horizon to which

¹ These specimens are to be found in the Arizona State Museum, Tucson.

² Douglass, A. E., December, 1929, p. 767.

³ By personal letter of January 27, 1930.

these sherds belong is to be found elsewhere in the ruin. Features which correspond in all sherds are: A rather coarse-textured paste is used which burned red with a dark core; tempering consists of crushed rock of light color and possibly a small amount of pulverized potsherds; the slip is of a deep red color applied both inside and outside of bowls; vessel forms consist of bowls only, and these are unusually deep¹ with slightly incurved rims and rounded or squarish lips; the

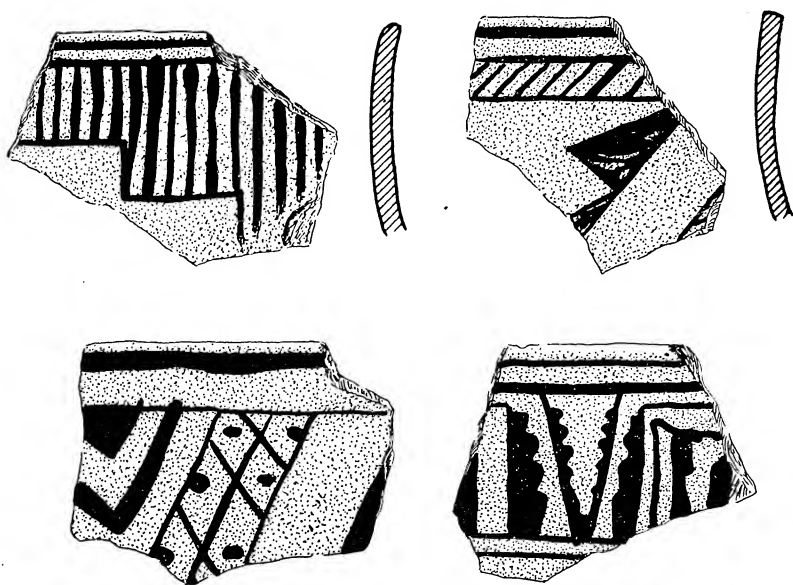


FIG. 5.—Black-on-red sherds from Showlow ruin which probably antedate the lower horizon. ($\frac{1}{2}$ actual size.)

decoration is in a thin black paint which has a slaty appearance and in some places is obliterated. Brush-work is very crude; lines were over-carried and variable in width. A narrow black line below the rim on the inner surface is characteristic of all the fragments in the collection. The designs consist of rudimentary hatching, dentate elements, terraces, and triangular figures. These are separated from the rim-line by a narrow unpainted zone. There is no exterior decoration. If the inference is correct that this type is aberrant to the lower horizon, belonging to an older culture stratum, its age is unquestionably pre-1200. While the provenance of this ware is not clear, I am of

¹ The Showlow collection in the possession of Gila Pueblo, Globe, has several complete examples.

University of Arizona, accepted an invitation from the National Geographic Society to extend his researches in dendro-chronology to include such beam material as might be provided by the Society's expeditions. While the age of Pueblo Bonito was the Society's sole objective Dr. Douglass' chief interest lay in the evidence of sun-spot influences and climatic variations as revealed by the annual growth rings of the timbers.

Three separate collecting parties, under the general supervision of Dr. Douglass and myself, were sent out by the Society in the summers of 1923, 1928 and 1929. Mr. Haury has briefly reviewed the purpose and results of these successive expeditions in his introduction. It should be emphasized, however, that we had a definite plan constantly in mind; that we worked as directly as possible toward our objective. When Dr. Douglass had brought his ring-record into two separate sequences we sought to join them into a single series. It was the Third Beam Expedition, that of 1929, which finally crowned this unique adventure with success.

As Mr. Haury states, a certain transient phase of Pueblo pottery provided the clue to ruins which immediately antedated Oraibi, the inhabited Hopi village from which Dr. Douglass had secured his oldest historic timbers. From collections in the United States National Museum and elsewhere a list was prepared of 20 prehistoric villages from which that particular type of pottery had previously been gathered. Our 1929 reconnaissance was undertaken for the purpose of eliminating from that list those ruins in which there seemed little likelihood of finding charred fragments of pine ceiling beams, for only thoroughly charred timbers could have resisted seven centuries of decay in an exposed site. Of the ruins visited on that preliminary survey four only were selected for partial examination: Kin Tiel and Kokopnyama, north of the Little Colorado River, and Pinedale and Showlow, in the forested area to the south. Mr. Hargrave, from his more intimate knowledge of early Hopi cultures, was placed in charge of excavations at the two former sites; Mr. Haury, at the latter two.

In the pages which follow, Messrs. Haury and Hargrave describe their individual efforts in the four ruins above named. Since these are more or less well known to all students of Pueblo archeology, it is felt that the authors' observations will form a welcome addition to the rapidly growing literature on the Southwest, especially in view of the fact that each of the ruined villages has now been correlated definitely with our own calendar.

the opinion that it is parental to the later orange-red decorated ware which bears the white exterior and black interior decorations.

This latter form is nearly as abundant as the black-on-white in the refuse of the first occupation. It has commonly been referred to as Little Colorado polychrome and was undoubtedly the most ubiquitous pottery known to the Southwest. In this instance it is an orange-red phase instead of the deeper red which it usually takes. Its presence was one of the guides used by Doctor Douglass in selecting sites which would provide the gap material for his tree-ring chronology. The paste is of a gray color, which shades to a light gray towards the surfaces of the vessels. Tempering material of coarsely pulverized sherds is abundant. The slip varies from a dark to a light orange-red color and is unusually thick. By actual measurement it was found to be one-twentieth of an inch thick in one case. Vessel shapes are exclusively bowls with pronounced incurving rims. Interior ornamentation is in dull black pigment (pl. 8, no. 1) consisting mostly of repeated interlocking or opposed solid and hatched figures. These are confined in a broad horizontal zone by two narrow framing lines, one below the rim and the second towards the center. The center of the bowl is thus left undecorated. Exterior decoration is made up of broad, rudely drawn, white stepped lines or terraced figures (pl. 8, nos. 2, 3, 4). These are also limited to a horizontal zone below the rim but never as wide as the one on the interior. A very small number of pottery fragments of this type show the use of white as a complementary color to the black on bowl interiors, and, conversely, the use of black on exteriors. These are believed to be local prototypes of an upper level pottery and will therefore be considered later.

Corrugated ware of the first horizon appears to consist almost solely of large ollas. The paste is gray to nearly black, quartz tempered and crumbles easily. The coils are not very fine and the indentations are shallow (pl. 9, fig. 1). Attempts at decoration by leaving a series of coils unindented as in 5 and 7, or other techniques, are seldom met with. Fragments of finely corrugated bowls bearing white exterior designs (pl. 9, fig. 1, nos. 4, 6, 10) and blackened interiors were rare in the lower level but occurred frequently in the northeast section of the ruin which we believe to be older still than the first horizon. This form is possibly best known from the Upper Gila. Its abundance at Showlow and at Pottery Hill¹ suggests local manufacture and thus may indicate a direct link between the southeastern sub-culture.

¹ Hough, Walter, 1903, p. 300.

Trade pieces are represented by a few scattered fragments of Pinto polychrome bowls,¹ *i. e.*, black-on-white interiors and undecorated red or reddish-brown exteriors.

Upper level pottery.—Turning now to the upper level pottery we find that radical changes took place during the interval of time represented by the abandonment.² Lower level forms had ceased to exist; new forms had been invented and the area was being penetrated by trade vessels from several adjacent regions. This second horizon, to which we can give the general dating of A. D. 1375, existed through to the devastation of the village by fire.

In the upper level, black-on-white is practically absent. The few scattered sherds probably represent survivals from the preceding period when that form was in vogue. Black-on-red is entirely lacking as is also the form of Little Colorado polychrome here described.

Four-mile polychrome.—In speaking of the artifacts at Showlow, Bandelier remarks that he found "nothing unusual except the pottery, which resembles that at Tule."³ There are specimens with glossy decorative lines, but the glaze is more carefully applied, the designs more perfectly executed. . . ."

In 1897, Fewkes conducted excavations in Four-mile ruin,⁴ situated 4 miles from Snowflake, and about 2½ miles west of Taylor, Arizona. The predominating pottery type recovered by him was a "redware with black decorations having a margin of white."

The pottery thus briefly characterized by both Bandelier and Fewkes was found in abundance during our work at Showlow. It formed approximately 75 per cent of all the pottery during the time of its dominance. This type is not new to those familiar with the archeological literature of the Little Colorado drainage. Fewkes gives excellent color plates⁵ of it; other later investigators in that field also picture it. As far as we have been able to ascertain, however, little has been done toward a careful description of the ware or an analysis of its derivation and relationship to other types. Likewise it lacks a suitable name to accord it the distinction which it merits.

¹ The Medallion, 1930, pp. 4-5, pl. II.

² By the abandonment we refer only to the rather restricted section where double occupation was found to exist. It is likely that the pueblo was occupied continuously but with small local movements within the structure.

³ Located about 14 miles east of St. Johns.

⁴ Fewkes, J. W., 1904, pp. 136-164.

⁵ *Idem*, pls. XXI, XXII, XXIII, XXIV, XXV, XXVI, XL, XLVII.

Upon the suggestion of Dr. A. V. Kidder, at the 1929 Archeological Conference at Pecos, New Mexico, we here refer to this form as "Four-mile polychrome." Fewkes' Four-mile ruin seems to be the type site for Four-mile polychrome. There it is found in great abundance and in what appears to be its most highly developed stages. Furthermore, Four-mile ruin is the approximate focus of the known distribution of this pottery. Its distribution is roughly conterminous with the area drained by Silver Creek and its affluents. Notable sites not included in this drainage but where Four-mile polychrome is found in some abundance are Forestdale, Chavez Pass, Homolobi, and Cheylon. All of these, however, are peripheral to the drainage area in question. Trade pieces have been found as far south as Bylas, Arizona, on the Gila River; in the Tonto Basin; at Casa Grande, and as far north as the old Hopi ruins in the Jeddito Valley.

Technology.—A study of the technology of Four-mile polychrome reveals the traits on which the creation of this type is based. The constancy with which some of the characteristics occur is worthy of note.

The paste is light gray in color, usually merging into a dark gray core towards the inner part of the vessel walls, and sometimes appearing reddish outwards. The paste fires to a hardness sufficient to give breaks with fairly sharp and smooth edges. Tempering material consists of ground-up potsherds and small rounded grains of sand, these ingredients occurring in about equal proportions. There is also a relatively small amount of dark particles, apparently ground basalt. In plate 10, figure 1, is shown a quantity of tempering, enlarged four times, which was removed from a sherd of an unfired vessel. Small angular bodies of white slipped vessels can be detected. Plate 10, figure 2, shows an unfired sherd (four times normal size) containing a sizable fragment (circled) of a former red-slipped vessel. As may be supposed, the addition of tempering derived from pulverized sherds of various sorts would be apt to introduce a considerable variety of extraneous inorganic substances.¹ The quartz grains as well as particles which appear to be crushed basalt were probably used as tempering material in previous vessels.

The slip is an even red color unless over-fired, when it turns to dark brown or almost black. Before firing, the slip is yellow, being made of the yellow limonite. This is to be seen in the upper half

¹ The sherd collection, which has already been noted as having been made for the purpose of grinding, is ample evidence of this.

of the unfired sherd in plate 10, figure 2. The slip is thin, fairly well pebble-polished and rather soft, so much so in fact, that on the bottoms of vessels and other surfaces exposed to wear, it has been entirely worn away. In a good many cases, the surface is seamed with minute cracks.

Shapes.—Vessel forms of Four-mile polychrome are almost exclusively ollas and bowls, the latter predominating. Several olla shapes are noted:

(a) The largest ollas (fig. 6, *a*) are shaped somewhat like the polychrome ollas from the Middle Gila. The body is compressed vertically and the neck rises at a steep angle to form the mouth

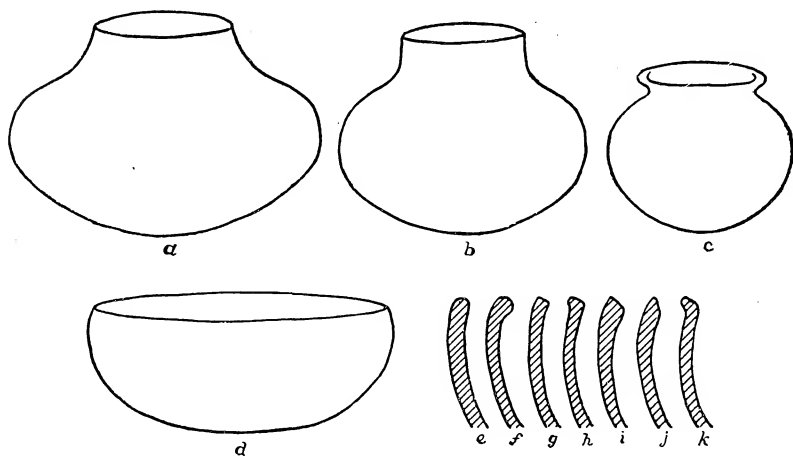


FIG. 6.—Vessel forms of Four-mile polychrome.

which is smallest at the rim. The lip is direct. As far as we know, only fragments of these exist.

(b) The most prevalent form of olla is much like the first excepting that the body is usually more rounded and the neck rises more abruptly (fig. 6, *b* and pl. 11). The neck is from 1 to 2 inches high and the lip always direct. The horizontal diameter seldom exceeds 12 inches.

(c) The third type (fig. 6, *c*) consists of small round-bodied ollas whose diameters vary from 5 to 8 inches. The neck is short or absent and the lip terminates in a decided flare. The mouth is larger in proportion to its size than was noted in the foregoing types.

Bowls (fig. 6, *d*) vary from 7 to 14 inches in diameter and are always less than one-half the diameter in depth. The rims are generally gently incurved and carried to the lip with or without thinning of

the vessel wall. The lips show a variety of treatment (fig. 6, *e* to *k*) in rounded, squarish, and bevelled forms. Bowls with rounded lips appear to be the rule.

Pigments.—The paints employed in carrying out the designs on Four-mile polychrome are black and white. The black paint is basically a lead glaze. Where thin it usually has a metallic luster and where thickly applied it is apt to be dull, sometimes vitreous and showing small granular bodies. It bit deeply into the slip, giving the black patterns permanency. The apparently gritty texture of the paint made it more difficult to manipulate than a free-flowing pigment, hence the brushwork does not show the clear-cut edges that it otherwise might have. Brush dips are clearly visible.

Quantitative analysis¹ of this glaze paint show that the main constituents are lead, copper, and usually some manganese. As one would expect in primitive pottery, where the pigments were not mixed by exact formula, the ingredients vary in proportion in the paint on different vessels. This fact possibly accounts for the slight difference in appearance of the paint. It is also likely that the length of time the pottery was subjected to fire and the intensity of the fire affected the final product. Individual paint determinations showed that lead and copper were almost always present in considerable amounts. A composite test of the paint on 12 sherds of Four-mile polychrome indicated a ratio of 1:2+ of lead to copper and the presence of a negligible amount of manganese. If the lead was in the form of an oxide when used, it would, upon heating, produce a silicate or glaze of light brown to yellow color. This silicate would promote the fusing of the copper and manganese compounds which impart the black color. The common occurrence of blue and green copper carbonates in ruins suggests that the copper element was added to the paint mixture in the form of a powdered carbonate. Heating would convert the carbonates to an oxide of copper of black color, which, being less fusible than the lead component, would tend to remain as the gritty particles already mentioned. The small amount of manganese present could have been combined with either the lead or copper ores when mined. Sodium salts which give a glaze similar to that of lead may also be present in the paint.

The white is a soft chalky paint that can be readily scratched off with a knife. As a result the white parts of the designs are often

¹ The chemical tests of glaze paints on pottery from Showlow and Pinedale pueblos were kindly made by Mr. F. G. Hawley, Chief Chemist, International Smelter, Miami, Arizona.

partly obliterated. While the white pigment may be considered to be of secondary importance in its use as an outliner for the heavier black lines, it was the first to be applied to the vessel surfaces in blocking out the designs and later supplemented with black.

Designs.—In the ornamentation of Four-mile polychrome, a stylistic divergence is noted from the usual trend of Southwestern pottery. The conventional repetition of elements in orderly zones and the involved interlocking elements noted on some of the lower level pottery are devices of the past. Instead, the field of design is broken up into irregular units and treated with a freedom and boldness previously unknown. In the latest forms, pure geometrical figures give way to conventional adaptations of life forms.¹

Olla decorations.—The several types of ollas are decorated much in the same manner. The neck and a small part of the upper-body are covered with a white slip which is carried well down on the inside of the neck. The white is seldom pebble-polished, hence rough and cracked. The remainder of the body is covered with a red slip and fairly well polished. There are two zones of decoration: (a) the white upper part and neck, and (b) from the lower edge of the white to a point not far below the maximum diameter of the vessel. The designs of the two fields are entirely different. On the white field the elements in black are simple and very often used independently. Crosses (fig. 7, *a* and *b*), "turkey tracks" (*c*), dots, stepped and paired lines (*d*, *e*, *f*, and *g*) are favorites. Elements represented in figure 7, *h*, *i*, and *j*, are appended to a continuous band placed just below the rim. The second field of design with patterns in black and white on red is a broad horizontal band bordered above and below with heavy black lines (pl. II, *a*, *b*, *c*, and *d*). It is divided into panels by broad black lines or otherwise divided off into recurrent units. White is used as a complementary color to the black. The design elements are essentially the same as those occurring in bowls, which are described later.

Bowls.—Decoration was applied to both interiors and exteriors of bowls, the principal design being on the inside. A very constant feature of inner decoration is a black band, $\frac{1}{4}$ to $\frac{1}{2}$ inch in width, placed immediately below the rim. It is invariably bordered by a narrow white line on the lower side only. In the majority of cases this band completely encircles the bowl. Where interruptions were made, the white lines are continued around the ends of the black band and extended upwards to the rim. The persistent occurrence of this rim-band, even in bowls where the rest of the interior was left

¹ For color plates see Fewkes, J. W., 1904, pls. XXV and XXVI.

unpainted, and a corresponding pair of lines on the rim exterior, may be considered as helpful marks of identification.

Separated from the black and white border by an undecorated zone from $\frac{1}{2}$ to 2 inches in width is the design area proper. It is normally of circular form. Only in extreme cases are the decorative elements appended directly to the black band at the rim. For an adequate understanding of these interior designs, we must resort to illustrations. In plate 12, *a*, the field of decoration is quadrate. Opposing quarters are paired and treated similarly. The whole is encircled by a heavy black border, outlined in white. In *b*, the field

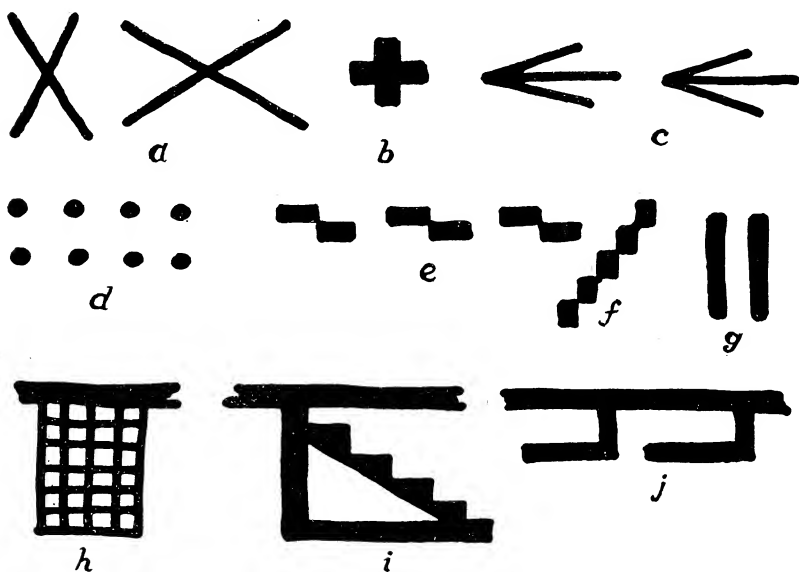


FIG. 7.—Design elements on Four-mile polychrome olla necks.

is divided into two opposing sectors which are connected by a medial line joining extensions of the arcs on opposite sides of the sectors. The designs in each of the latter are identical. The bilateral symmetry exhibited in these two bowls seems to be general in the early phases of Four-mile polychrome. In later forms the central field is treated with spirals, triangles, rectangles, sectors, or life forms, all parts of the design being connected, thus forming a continuous though not balanced arrangement. The design represented in figure 10, *c*, is typical of this feature.¹ The bowl figured in plate 12, *c*, is ornamented with a horizontal band 2 inches in width, placed

¹ For additional examples see Fewkes, 1904, pls. XL, XLVIIa.

3 inches below the rim. Four white lines dotted at regular intervals with paired rows of black spots are diametrically drawn across the central bare area. Specimen *d* is an excellent example of the uniqueness of design found in many Four-mile polychrome bowls. From the central black spot, a number of white lines terminating in black dots radiate rimwards. It reminds one of a child's drawing of the sun. It will be noted from the preceding vessels shown that rectilinear and curvilinear styles are used with equal skill, and that transitions from one to the other are made within the same vessel.

Bowl exteriors are treated in a very uniform manner. The ornamentation is confined to a horizontal zone beginning immediately below the rim and extending downwards for from $1\frac{1}{2}$ to 3 inches. This zone is enclosed by two parallel, heavy black lines. The upper one is outlined in white on the lower side only, while the lower one is framed on both sides. The designs introduced into the zone are in white except in the more elaborate instances where black also appears. Figure 8, no. 1, shows a simple continuous line pattern, and in nos. 2 and 3 concentric parallelograms and triangles are represented. Modifications of the fret or "dentiform" figures¹ are characteristic as in nos. 4 and 5. The zone is often panelled by one or more diagonal or vertical lines, or merely by the enclosing lines as in no. 5. Elements are usually repeated in each panel but sometimes with slight variations. In no. 6 we see a more elaborate treatment. Black diagonal, terraced, and plain vertical elements connect the top and bottom borders. To these further embellishment is added in white.

Elements of design.—The units of decoration in the main are not dissimilar to those generally employed in Southwestern pottery. The distinction of Four-mile polychrome designs, however, is based on the very singular treatment of the elements, a freedom from the conventional equating of the field of design. Obviously this paved the way for greater elasticity in the expression of the relatively few elements into innumerable variations.

Of the elements, the following appear to be of primary importance: (a) triangles, (b) terraced or stepped figures, (c) spirals, and (d) frets.

In figure 9, nos. 1 and 2, triangles are shown as they occur in their simplest forms, while in no. 3 a triangle is embellished in white, and in no. 4 may be seen a common modification of the triangle combined with another element. Frequently in the center of this geometric figure a small rectangular area is left unpainted, which is then either

¹ Spier, L., 1919, pp. 367-8.

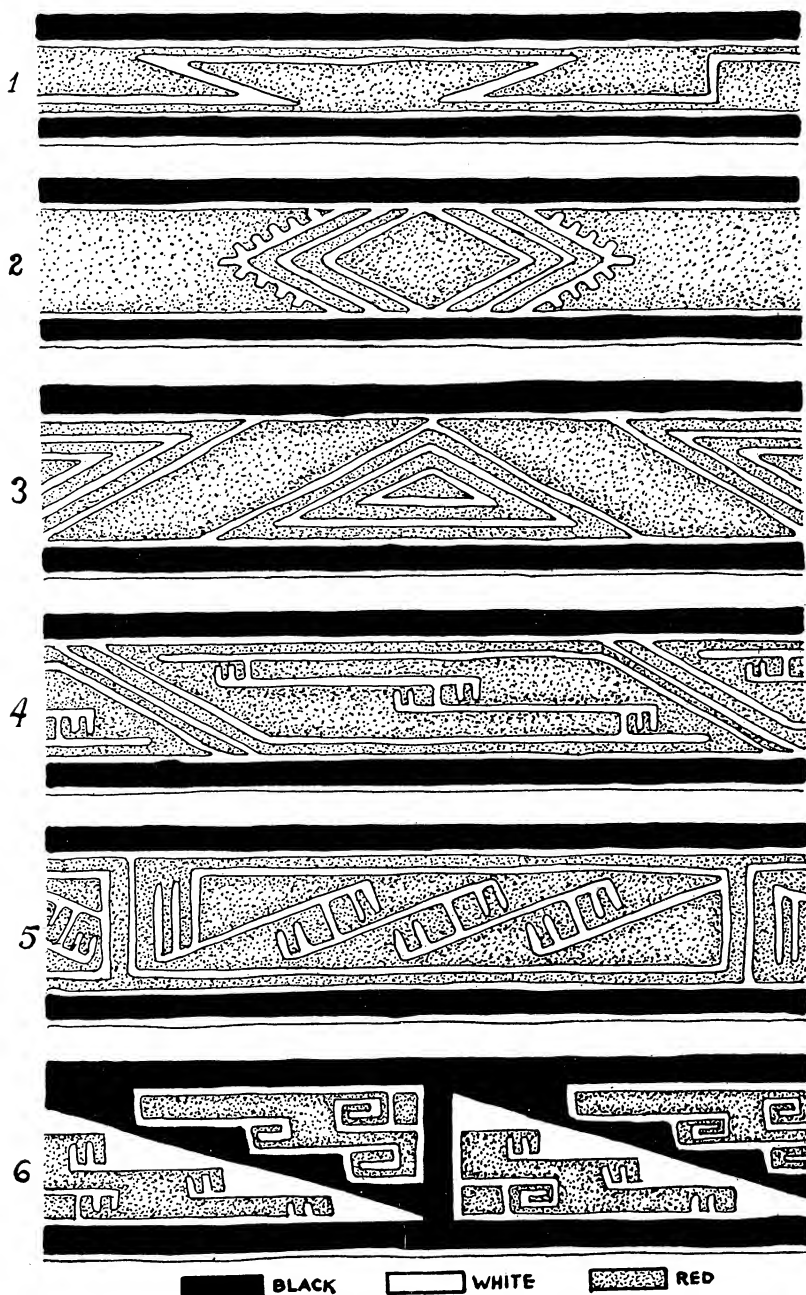


FIG. 8.—Typical bowl exterior decorations of Four-mile polychrome.

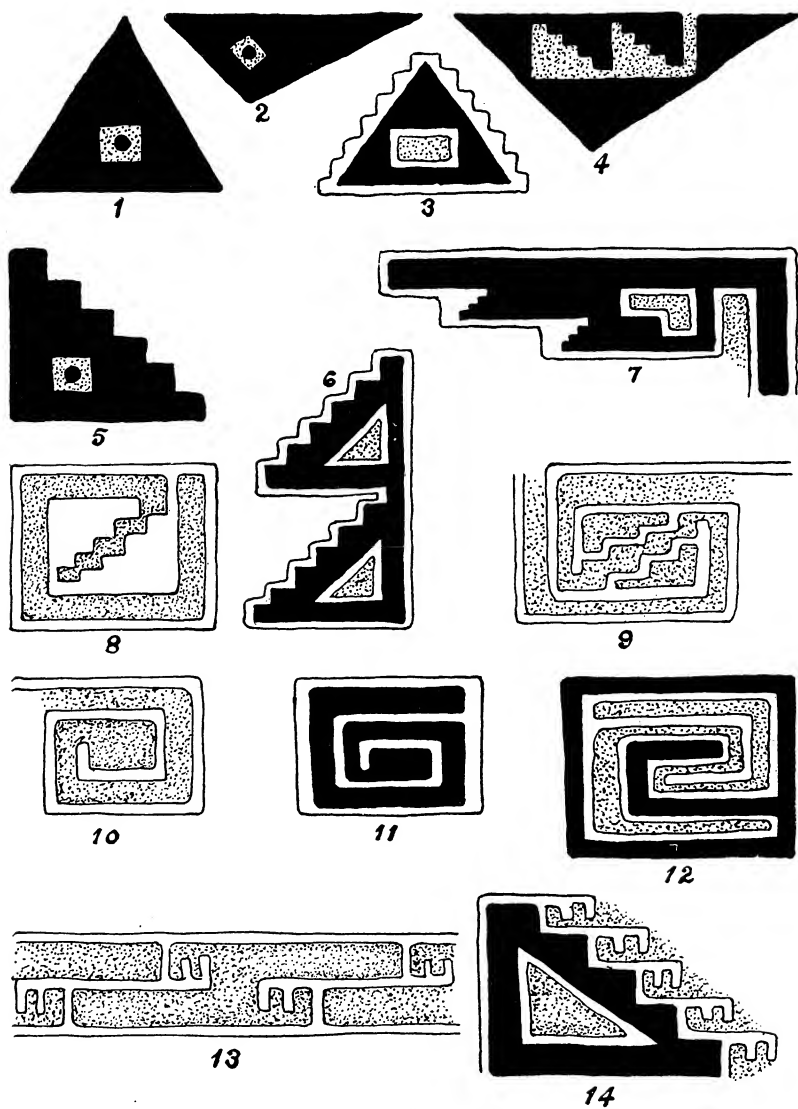


FIG. 9.—Design elements of Four-mile polychrome pottery.

In behalf of the National Geographic Society, Dr. Douglass and myself, I wish to take this opportunity publicly to acknowledge our joint appreciation of the zeal and industry exhibited by Messrs. Haury and Hargrave in pursuing the tasks individually assigned them; to further acknowledge our obligations to those citizens of Arizona who, by granting us permission to excavate on their lands and in other ways, contributed so directly to the success of this important undertaking. Especially are we grateful to the Directors and to Dr. Harold S. Colton, President of the Museum of Northern Arizona, at Flagstaff, for so generously placing at our disposal the valued services of Mr. Hargrave. Dr. Colton aided us still further by personally leading our 1929 reconnaissance party; by providing Dr. Douglass with temporary laboratory space in his museum; by expediting in every way possible the purpose of our concluding expedition.

NEIL M. JUDD.

*U. S. National Museum,
November 17, 1930.*

dotted in the center or outlined in white. Terraced elements (nos. 5, 6, and 7) are characteristic. They are used singly, in pairs, or in complex patterns and, less often, in opposed positions as in nos. 8 and 9. Spirals fall into two classes: (a) large curvilinear forms constituting a unit of the entire design (fig. 10, *c*) which are reminiscent of similar devices occurring commonly in Upper Gila black-on-white and in some Little Colorado polychrome but without the solid interlocking element; (b) small angled spirals used as filling elements (fig. 9, nos. 10, 11, and 12). The latter is an uncommon form of the interlocked spiral. Variant forms of the fret (fig. 9, nos. 13 and 14) also (fig. 8, nos. 4, 5, and 6) predominate on bowl exteriors. Combinations of the fret with the above listed elements are frequently used in bowl-interior and olla patterns.

Structure of designs.—The initial step in applying the decoration was to block out the area to be covered with narrow white framing lines (fig. 10, *a*). It is evident that the artist had a fair conception of the combination of elements that were to be used before the first pigment was applied. Where panels were to be filled with white only, as in the case represented, that was done before the next color was taken up.

The second step consisted of applying the heavy black lines inside the white borders (fig. 10, *b*). The width of these varies somewhat. If drawn within areas later to be filled with other elements, they are seldom more than twice as heavy as the white, but where the white framers connected parts or surrounded the design, the black lines are heavier.

In the final stage, all bordered areas are filled with coarse hatching (fig. 10, *c*) which ordinarily parallels the longest side of the block. A variant of hatching is to be noted in the spiral where sets of parallel lines are offset by appended dots. Heavy stepped lines are also used with hatching as fillers.

The dating of Four-mile polychrome is made possible by a number of cases of its association with timbers that yielded cutting dates. The last big construction period in the Showlow ruin extended over approximately 25 years prior to 1383. The latter date is the most recent cutting date found in over 1200 specimens gathered from various parts of the pueblo. It appears, then, that no major building was going on after 1383. In 15 rooms belonging to the period in question, Four-mile polychrome was invariably present. This means that the pottery found in a room constructed in, say, 1375, would likely



A



B



C

FIG. 10.—Steps in the application of a design in a Four-mile polychrome bowl.

be post-1375, provided the associated pottery was not exotic but representative of local types at that time. The finding of Four-mile polychrome in these 15 rooms places its time unquestionably as shortly after 1383, although it was present in rooms dating 1375 and may even have been in existence 25 or 30 years earlier. That it had not been developed by A. D. 1300 is shown by the results of excavations at Pinedale, where an antecedent form was in existence at that time and Four-mile polychrome was absent. Nor do we know exactly how long it survived after 1383. Showlow ruin was probably abandoned at the close of the 14th or early in the 15th century just before the Hopi Jeddito black-on-yellow penetrated the region in any appreciable amount. In addition to its characteristic polychrome,¹ Four-mile ruin contains an abundance of the Hopi yellow (Jeddito black-on-yellow) which would place the abandonment of that site after Showlow. But how long after, we are not ready to say. The absence of Sikyatki polychrome at Four-mile ruin implies its abandonment prior to 1450 A. D.

Plain redware.—In the later period at Showlow plain red bowls and ollas were made and used. Sherds were not found in the lower deposits.

A nearly complete, plain red olla seems representative as far as our sherd collections show. Its paste is gray and tempered with coarse sand; its outer surface bears a red slip. Firing clouds are common on these plain red ollas. The shape is similar to the Four-mile polychrome ollas except that the upper body is flatter and the neck more cylindrical. Plain red bowls are technologically the same as Four-mile polychrome bowls except that the decorations are omitted. Several nearly complete specimens and numerous sherds indicate that they were seldom over 8 inches in diameter.

Corrugated.—In the upper Showlow level, corrugated pottery occurs only as ollas. The paste is gray, quartz tempered, and crumbly. Corrugations and indentations are much the same as in vessels of the older horizon (pl. 9, fig. 2, nos. 1 and 2), but a new treatment, not found in the lower rooms, has come into general use. In this the coils were so manipulated as to give the surface shallow horizontal flutings or ribs (pl. 9, fig. 2, nos. 3, 4, 5, and 6).

The finely corrugated vessels bearing exterior decoration are absent in this level.

¹ Type specimens of Four-mile polychrome vessels are to be seen in the U. S. National Museum; Gila Pueblo, Globe, Arizona; Arizona State Museum, Tucson; and the Museum of Northern Arizona, Flagstaff.

MISCELLANEOUS POTTERY OBJECTS

Parching plates (?).—Utensils formed of fragments of broken clay vessels were occasionally encountered in the diggings. From room 2, test 16, two small plate-like vessels were collected. The larger of the two (pl. 13, fig. 1, *a*) is $7\frac{1}{2}$ inches in diameter and $1\frac{1}{4}$ inches deep. It is made from the bottom part of what appears to have been a large smooth red olla. The edge, although irregular, has been ground down to remove all rough places. The smaller plate (pl. 13, fig. 1, *b*) is $5\frac{1}{2}$ inches in diameter and made from the base of a corrugated olla. Its edge is not finished as in the former specimen. Fragments of a larger but similar vessel came from room 2, test 3. It is approximately 12 inches in diameter and 4 inches deep, and at one time formed the bottom of a thin, plain red olla.

As to their use, it is not unlikely that they served as parching plates for corn. The dark irregular centers and light edges of both plates pictured show that they were used over hot coals since their manufacture from the original vessels. That they were also put to other uses, such as containers for pigments, etc., is suggested by an incrustation of fine clay-like material on the inner surface and on the under side along the edge of specimen *a*. This substance is apparently the same as the material used for red slips on vessels.

Pottery scrapers.—Several objects made of potsherds and used in scraping the surfaces of unfinished clay vessels were recovered in Showlow ruin. The nature of the vessel on which a scraper was to be used apparently governed its size and shape. One specimen is ovate, measuring $4\frac{3}{4}$ by 3 inches; another is of semi-circular form and considerably smaller. The wearing on all, however, indicates that the convex surfaces advanced in the scraping stroke.

Intrusive pottery types.—In rooms from which the latest cutting dates were recovered, there appeared occasional fragments of vessels obviously foreign to the Showlow district. Some of these undoubtedly came from the Zuñi region, not a great distance to the east. And Middle Gila pottery¹ is represented by a very few bowl sherds showing the characteristic red on the outside and the black-on-white internal decoration.

The following Zuñi types, as established by Hodge in his work at Hawikuh² are represented in our collections from the upper Showlow level: Type C, by a sherd of a full-bodied vessel with black glaze on

¹ Gladwin, H. S., September, 1928, p. 20.

² Hodge, F. W., 1923, p. 29.



1. The extreme north end of the Showlow ruin, looking west. Beam HH-39 was found at the point where the man with the straw hat is at work.



2. Showlow. Room 2 of test II, built between A. D. 1378 and 1382.



1. Showlow. Charred roof timber (below bowl) in test 11, room 2, which dated A. D. 1378. The bowl was on the roof when the fire occurred.



2. Showlow. A second timber in test 11, room 2, which also gave A. D. 1378 as the terminal date.



1. Showlow. Basal part of an old wall showing the use of large blocks surmounted by small stones in poorly constructed horizontal courses.



2. Showlow. Exceptionally good section of lower-level wall uncovered in test 12, composed of alternating layers of large blocks and small spalls.



1. Showlow. The diggings at the right are tests 1, 2, 3, and 12 where the excavated rooms were found superimposed upon older structures.



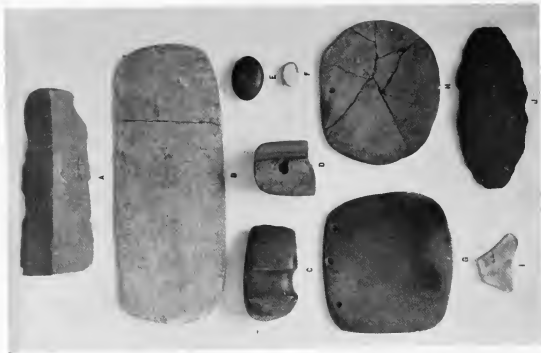
2. Showlow. Room 1 of test 2 showing the firebox near the center of the room.



1. Showlow. Room 1 of test 2 showing a second firebox in a lower floor.



2. Showlow. Complete excavation revealed the latest firebox imposed upon a wall foundation of the older structure.



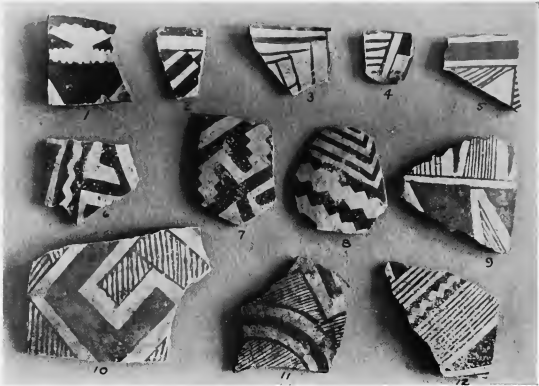
1. Stone implements from Showlow ruin.

a. Mano, 8" long; *b.* mano, 12½" long; *c.* stone axe; *d.* stone pebbles; *e.* *f.* polishing pebbles; *g.* *h.* sandstone; *i.* sandstone; *j.* sandstone.

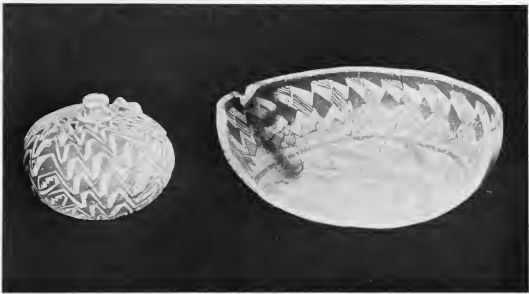


2. Showlow. A sandstone kneading board found among a potter's accessories.

(Length, 33 inches; width, 17 inches.)



1. Lower level black-on-white sherds, Showlow ruin.



2. Black-on-white canteen and fragmentary bowl recovered from a lower level firebox, Showlow ruin. (Diameter of canteen 6 inches.)



1



2

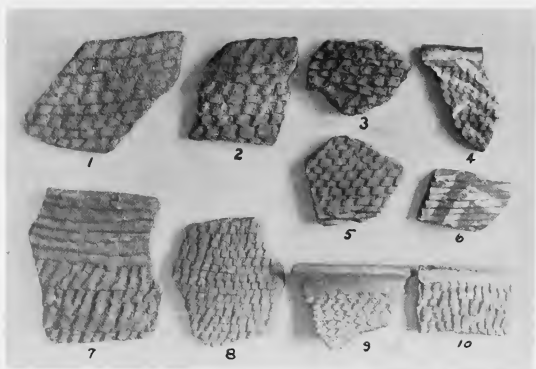


3

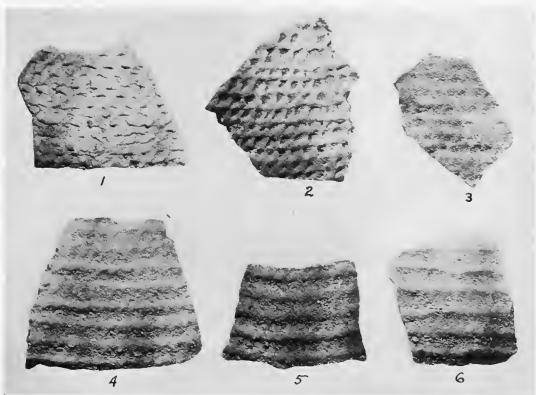


4

Interior (1) and exterior (2, 3, 4) patterns of decorated orange-red ware, commonly known as Colorado polychrome, Showlow ruin.



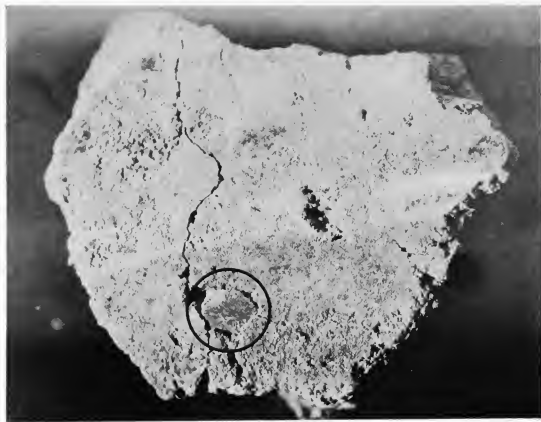
1. Lower-level corrugated ware, Showlow ruin.



2. Upper-level corrugated ware, Showlow ruin.



1. Showlow. Tempering material consisting of pulverized sherds, quartz grains, and a small proportion of crushed basalt found in the paste of Four-mile polychrome pottery. (Enlarged four times.)



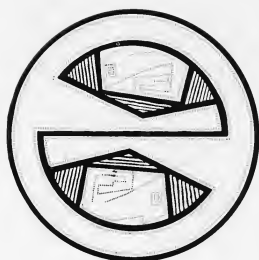
2. Showlow. An unfired sherd of Four-mile polychrome pottery showing an inclusion (circled) of a fragment of a fired vessel. (Enlarged four times.)



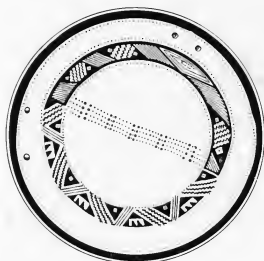
Four-mile polychrome ollas dating about A. D. 1375 from Showlow ruin.



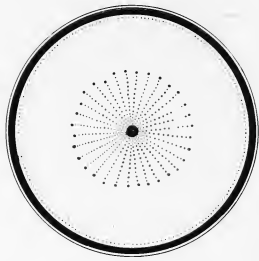
a



b

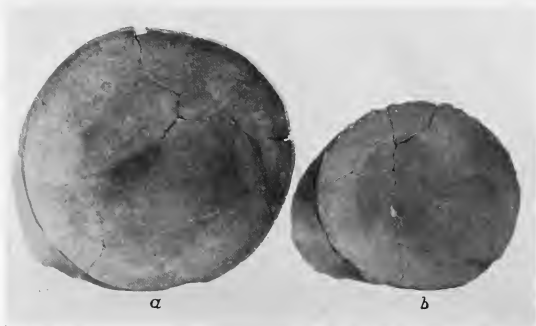


c

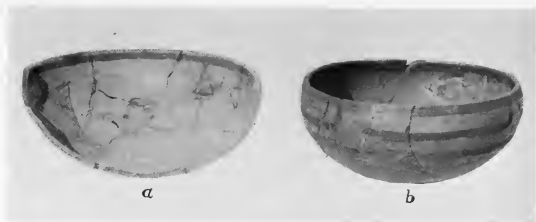


d

Designs on Four-mile polychrome bowls from Showlow ruin.



1. Parching plates (?) from Showlow ruin. (Diameter of *a*, $7\frac{1}{2}$ inches.)



2. Fragmentary bowl of Hawikuh type E (*a*) and imitation bowl of old Hopi black-on-yellow (*b*), upper-level, Showlow ruin.

a white slip and by a bowl fragment with greenish glaze on a cream slip; Type D, by a cream-colored bowl fragment ornamented with green glaze and red, a non-glaze color. Hodge's Period E is probably represented by the fragmentary bowl pictured in plate 13, figure 2, *a*, in which the designs are rudely executed in a dark buff, non-glaze color on a light buff background. A similar bowl, with black glaze decoration, is to be found in the Showlow collection now at Gila Pueblo, Globe, Arizona. All of these Hawikuh types came in well towards the end of the occupation of Showlow ruin.

Jeddito black-on-yellow, the early forms of which appear to have come into use soon after 1300 in the great ruins of Jeddito Valley, was almost unknown at Showlow as late as 1383. A single sherd of this type was found in room 2, test 2, with timber that dated approximately 1375, but that it was better known than this one sherd would indicate is evidenced by what we have interpreted as local imitations of Jeddito ware. The bowl figured in plate 13, figure 2, *b*, has a yellowish surface decorated in black by an uninterrupted line below the rim on the inside and by simple angled figures attached to the rim line on the outside. Olla fragments are also noted. In all specimens the base clay is dark and coarse, surfaces pebbly, and the designs are in black glaze paint. While the designs do not exactly duplicate those found on the Jeddito yellow ware, they show points of similarity.

PINEDALE RUIN

Pinedale ruin is situated in Navajo County, Arizona, about half a mile southeast of Pinedale, and 16 miles west of Showlow ruin. Less than a mile to the east of the pueblo is Morterson Wash, a tributary of Silver Creek.

The ruin consists of two units. The first is a large rectangular area surrounded by single tiers of one-story rooms. The second is a structure of compact form, the rooms of which are grouped about a central rectangular plaza (see fig. 11 and pl. 14, fig. 1). The east, west, and south sides bear proof of having been two stories in height, terraced away from the court, while the north end of the plaza appears to have been open or partly closed by single-storied rooms. Extending eastward for approximately 100 feet from the northeast corner of the main pueblo is an additional wing of rooms several tiers in breadth. It was in the large compact unit that the search for charcoal was continued after work had stopped at Showlow.

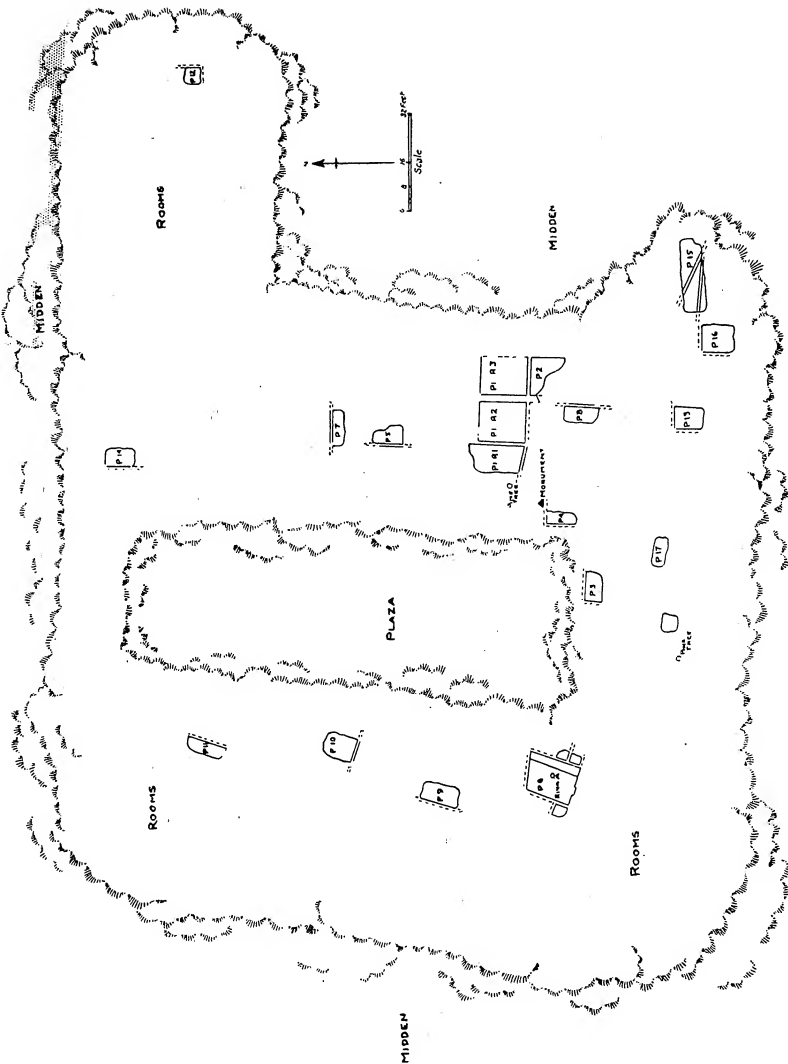


FIG. II.—Plot of Pinedale ruin showing Beam Expedition excavations.

Before the present operations were started the surface was found to be pitted here and there by the work of previous excavators and pot-hunters, and by shallow trenches where rocks had been removed for building purposes. Residents of Pinedale informed us that as late as 1887 sections of walls were still standing to a height of from 3 to 4 feet above ground. These as well as parts of some walls not exposed were subsequently removed by the early settlers for building stones. Rubbish heaps are located on the east and west sides of the main unit, and lesser deposits of débris are to be found along the north side of the east wing. Fewkes¹ worked the east midden extensively for burials in 1901.

Our search for charcoal in the Pinedale ruin showed the existence of a different condition from that noted at Showlow. Out of a total of 21 rooms opened, only four produced charcoal or otherwise indicated that they had been destroyed by fire. From all appearances, the pueblo was evacuated voluntarily some years before the Showlow ruin as we will endeavor presently to show. These burned rooms are no doubt the results of accidents; in only one instance did we observe what appears to be intentional firing.

For the initial test, a place was selected in the southeast section near the plaza. In an older excavation near this spot, charcoal was in evidence. This test, designated in figure 11 as P1 (P is equivalent to the symbol T of the Showlow workings), was eventually extended into three adjoining rooms, two of which were burned. The east half of room 1 was excavated and the remainder was left undisturbed because of the presence of a growing pine tree. Small charred beams showing short ring records were recovered from this room. Room 2 proved to be of interest because of its use as a depository for rubbish both before and after its burning. Several good beam sections, EH-56 (see pl. 15, fig. 1, for photograph of this beam *in situ*) and EH-62 were recovered whose outer rings dated 1286 and 1273 respectively. Room 3 was unproductive of charcoal, hence only partially excavated.

Tests 3, 4, and 5 all showed an unburned condition. Test 6 developed into a kiva which to our good fortune was burned. All charcoal was either directly on the slab floor or on the platform along the east wall, indicating that its destruction probably took place while it was in use. Here two good beam sections were encountered, as well as numerous small fragments. Specimen EH-68 is a section of a pine plank about 18 inches long, 10 inches wide, and $2\frac{1}{4}$ inches thick. It rested on the platform about midway between the east and west wall (pl. 15, fig. 2) and may originally have been a part of the frame of

¹ Fewkes, J. W., 1904, pp. 164-167.

the hatchway. The specimen does not give a true cutting date, but the last ring, obviously near the outside, reads 1131. The second charred beam, EH-69, was found in the south end of the kiva, partly overlying the platform. It consisted of a short section of a timber about 7 inches in diameter, but unfortunately was charred only externally and was badly decayed on the interior. Its outermost ring gave the year 1207.

Test pits 7 to 19, inclusive, all failed to produce charcoal.

ARCHITECTURAL FEATURES

The walls in Pinedale pueblo were, on the average, far better than those described from Showlow. In spite of the fact that much of the structure had been two stories high, the walls are seldom more than a foot thick. An exceptionally good section of wall exposed in P-16 may be seen in plate 14, figure 2. This wall, uncovered to a depth of 7 feet, was uniform throughout and chinked with small thin spalls. The larger stones average 4 inches in thickness and are carefully dressed both on the exposed surface and on the ends. Unusually large slabs were employed, the second one below the whisk broom (pl. 14, fig. 2) measuring 4 feet in length. Others of 3-foot lengths were not uncommon.

Room 2, in the first test, was the largest excavated. Its dimensions are 15 feet north and south by 13 feet east and west. The floor level was found over 10 feet below the surface, which is ample evidence of the existence of a two-story structure on that spot. That weaknesses of construction occasionally developed is noted in the east wall. Its lowest 5 feet are made up of large blocks of sandstone placed in position without any effort at coursing. Above these, smaller blocks are put down in courses and chinked with small spalls wherever the irregularities demanded. The weight of the superimposed story apparently caused this wall to buckle inwardly (pl. 16, fig. 1). Occupants of the room, in an attempt to strengthen the wall, blocked the doorway which leads into the room beyond. This had little effect and eventually the threatening wall caused abandonment of the room. Subsequently it was used as a dumping place for trash which consisted of broken pottery, ash, discarded implements, etc.

The doorway, unlike the usual pre-Spanish Pueblo door, is at the floor level. Its dimensions are 22 by 28 inches. Near the center of the room was a fire-pit, oval in shape, dug into the clay floor.

KIVA

Unquestionably the most interesting architectural feature uncovered at Pinedale is a rectangular kiva, one of the few known of that form

south of the Santa Fe railroad. The kiva site was marked by a surface depression at the southwest corner of the plaza. A test pit revealed a flagstone floor at a depth of 5 feet; above this, burnt soil and charcoal encouraged our hope that we might find here suitable timbers from which the room could be dated. This hope was subsequently realized; from several fragmentary timbers and numerous small pieces of charcoal, Doctor Douglass has been able to determine the approximate construction date of this ceremonial chamber.

The kiva was not perfectly rectangular nor was it accurately oriented as to the cardinal points. The long axis of the chamber had an approximate bearing 20 degrees east of north. The inner dimensions are as follows:¹ north wall, 13 feet 3 inches; south wall, 13 feet 3 inches; east wall, 17 feet 3 inches; west wall, 15 feet 5 inches.

Masonry.—The kiva masonry was inferior to that in neighboring dwellings. Its building stones were generally unshaped although a great many carefully dressed blocks, apparently fallen from the adjacent two-storied rooms, were removed from the débris which filled the kiva. Adobe mortar was plentifully used, the walls were never more than a foot thick and horizontal coursing of building stones was practically absent.

The west wall, 6 feet from the northwest corner of the kiva (see fig. 12), curves slightly to the east and then back to the west again. At this same point is a distinct vertical separation in the masonry which we interpret as the place of juncture of two walls of a former room. This suggests, as several other points did also, that the kiva was remodelled from previous living rooms.

The central part of the east wall had collapsed. We rebuilt this portion in 1929 in a manner readily distinguishable from the original masonry.

In the west half of the south wall is a shallow offset (pl. 16, fig. 2; text fig. 12, a) 1 foot 10 inches wide and 4 inches deep. Its significance is not known to us.

Plaster.—Originally the inner walls of the kiva and the face of the platform were covered with adobe plaster. Small patches still adhering to the walls showed upwards of 11 coats or separate applications with a total thickness of $\frac{3}{4}$ inch. There was considerable variation in the color of the several plaster layers; some were excessively smoke-blackened while others were less so, probably denoting long or short elapses of time between renewals of plaster.

¹ In treating of the descriptive material of the kiva, the sides will be referred to as being either north, south, east or west, although these were not exactly oriented to those points.

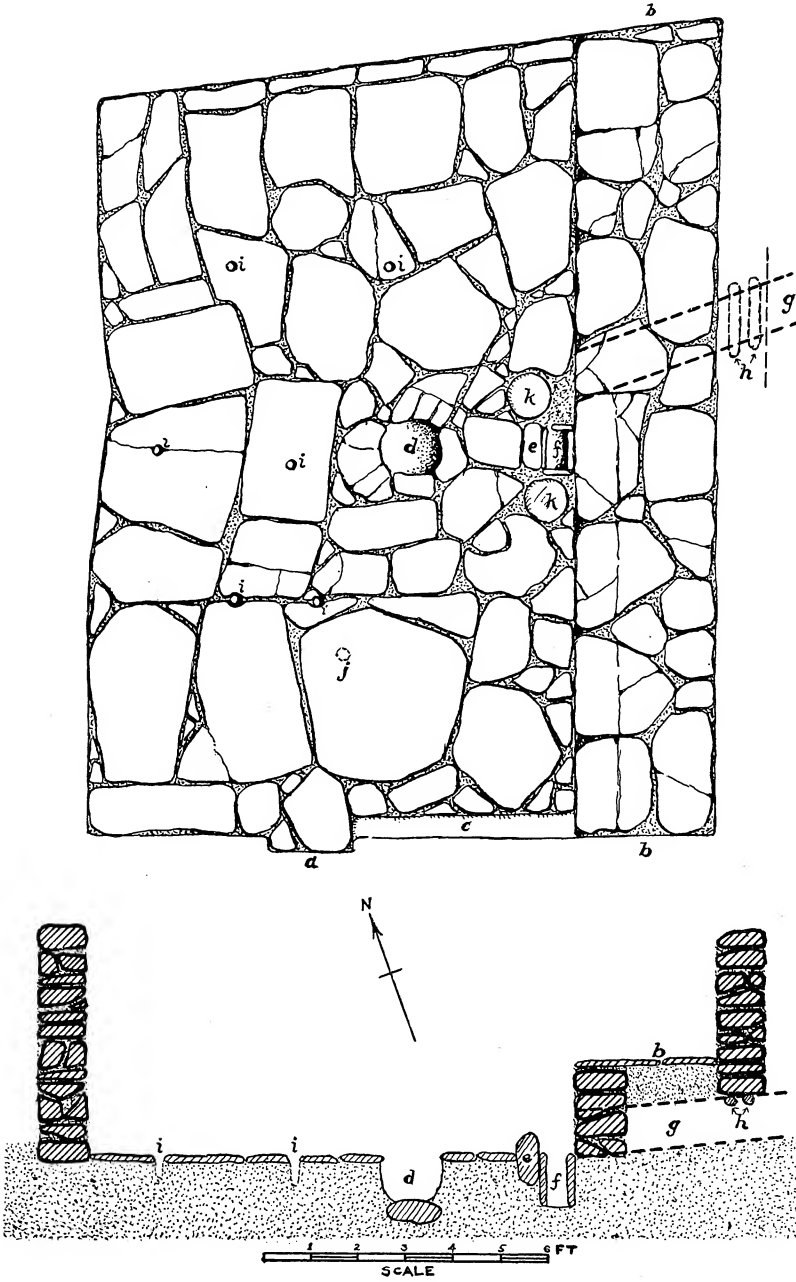


FIG. 12.—Plan and section of Pinedale kiva.

SHOWLOW AND PINEDALE RUINS

By EMIL W. HAURY

INTRODUCTION

The year 1923 marks the inception of a new method for ascertaining the actual ages and determining the chronological sequence of South-western ruins—a method devised by Dr. A. E. Douglass and based upon the annual ring-growth of certain coniferous trees. A brief summary of the results of this seven-year investigation has recently been published by him in the *National Geographic Magazine*.¹

Doctor Douglass has conclusively shown that the width of annual rings of pine in the Pueblo area is conditioned by the amount of precipitation; thus, in wet or favorable years, ring-growth will be normal, while in drought years the growth will be sub-normal, the width of the rings decreasing with the severity of the drought. He has shown also that practically all trees over a large area record the periodical fluctuations in moisture in identically the same way. Commenting further on this point, Doctor Douglass says in his recent article:

The same succession of drought and plenty appears throughout the forest. . . . Certain sequences of years become easily recognized from tree to tree, county to county, even from State to State.

Furthermore, it has been shown to be highly improbable that a given ring-sequence with its characteristic narrow rings will ever be exactly duplicated. In the present continuous calendar which extends over a period of 1,200 years, duplications in even short ring-records have not been discovered.

With the above facts in mind, it should be possible by a method of cross-dating or over-lapping the inner rings of one beam with the outer rings of another, first in living trees and then in old timbers cut by man before the living trees started their record, to build up a chronology which would extend far into the past.

In June, 1923, the First Beam Expedition of the National Geographic Society entered the field for the express purpose of recovering

¹ The secret of the Southwest solved by talkative tree rings. *Nat. Geogr. Mag.*, Vol. 56, No. 6, pp. 737-770, December, 1929. Doctor Douglass will elaborate his methods and results in a paper to accompany the report on the Pueblo Bonito explorations, by Neil M. Judd, now in preparation.

Platform.—This feature, which is typical of the rectangular kivas of the Little Colorado drainage, extends the full length of the east wall (fig. 12, *b*); the normal old Hopi kiva, however, is benched at the south or southeast end across the shortest dimension of the room. Its maximum width is 3 feet; its height at the south end is 2 feet 2 inches, but at the north only 1 foot 10 inches. The front of the platform, made of the same nondescript masonry as that found elsewhere in the chamber, supported a fill of loose earth at the north end and, at the south end, of clean coarse sand. This filled space was then capped with thin sandstone slabs to form the bench floor.

Referring to plate 17, figure 1, it will be noted that the capping slabs at the south end of the platform had collapsed under the weight of the débris forced upon them. This may denote the existence of a hollow space there at the time of destruction and also suggests that the sand may have been contained there for a definite purpose. What that may have been we do not positively know, but judging from modern practices, the sand could well have been used in forming the ground work of sand paintings constructed during ceremonial observances. The platform would make a convenient storage place for that material and could be easily reached by removing the slab covering. Hargrave's¹ finding of two large sand-filled ollas buried under the floor in a kiva at Kokopnyama probably signified a similar custom.

Bench.—The kiva is without a true bench or banquette. The merest suggestion of one exists along the south wall (pl. 16, fig. 2; text fig. 12, *c*) from the east side of the offset to the platform. It measured 7 inches in width and 2 feet 4 inches in height.

Floor.—The floor is completely paved with sandstone slabs from 1 to 2 inches in thickness. These vary in size from slabs 3 and 4 feet in length to small pieces which were fitted into corners and crevices. The larger flagstones were carefully placed, leaving only small cracks which were later filled with clay.

Fire-pit.—Two feet 9 inches from the platform and midway between the north and south walls is the fire-pit (fig. 12, *d*), a circular opening in the floor, 16 inches in diameter and 11 inches in depth. The bottom of the pit was formed by the convex surface of a large water-worn boulder. Wood ashes completely filled the fireplace.

Deflector.—No true deflector or fire screen, such as those usually associated with early Pueblo kivas, was found in the Pinedale chamber. Less than 2 feet east of the fire-pit, however, a stone 10 inches wide by 4 inches thick protruded 6 inches above the flagstones (fig. 12, *e*). Inasmuch as this stone was not directly in line

¹ See page 112, hereinafter.

with the fire-place and the ventilator opening, and also because of its low height, its function as a deflector must be regarded as doubtful.

Ventilator.—The ventilator shaft connects with the room through an opening in the front of the platform. This opening, a foot square at the floor level, is located 7 feet from the northeast corner (fig. 12, *g*; pl. 17, fig. 2). Leaning against the platform immediately north of the vent was a squared slab which fitted the opening. The duct passes under the platform at an angle; it is stone-lined and its floor rises slightly to pass under the east wall of the chamber. While two wooden beams (fig. 12, *h*) supported the wall at this point, there was no indication that the platform slabs above the passage had been similarly supported. As already mentioned, the east wall at about this point had fallen away, making it impossible to determine whether or not the shaft continued vertically to the surface.

Sub-floor depository.—Situated between the problematical deflector and the platform is a rectangular hole (fig. 12, *f*) measuring 10 by 6 inches by 13 inches in depth. The sides are formed of rock slabs which protrude slightly above the floor. This pit was filled with black earth.

Floor perforations.—Six holes pecked through the floor flags (fig. 12, *i*) may next be mentioned. When the first one was discovered, west of the fire-pit and in alignment with the usual kiva features, it was considered to be the sipapu. Later, however, five other similar openings were exposed, leaving some doubt as to the presence of a true sipapu. The first opening west of the fire-pit is 1 foot 10 inches away and the second a foot from the west wall. Both are 1½ inches in diameter. The two pairs to the north and the south are about equidistant from the center of the kiva but not equally spaced. Although not in alignment, as in Hopi kivas, it is not improbable that these holes once served as loom anchors. A seventh opening, plugged with a chipped stone (fig. 12, *j*), was found in the southern part of the room. The depth of these holes could not be determined.

The presence of two rounded stones in the floor (fig. 12, *k*), one on either side of the deflector, must also be recorded. They are somewhat thicker than the average floor flags and of a different material. Their significance, if any, is not known.

Roof.—The positions of a few sizable timbers lying across the kiva platform, indicate that the principal roof supports spanned the chamber across the short dimension, as would be expected. Further details could not be learned although numerous sections of branches a few inches in diameter were presumably fragments of cross pieces.

Relation to living rooms.—Exploratory tests into contiguous rooms, two to the east and one to the west, revealed the fact that the kiva

floor was only 4 inches lower than those of adjoining rooms. Thus the structure was not subterranean as is usually the case. The guiding depression in reality was due to the greater amount of accumulated débris from two-story structures to the north and south of the kiva. A single-storied room separated the kiva from the plaza. The bulge and separation in the west wall which has already been mentioned, the fact that the floors of the adjacent living rooms and that of the kiva were almost on the same level, and the proximity of the latter to the domiciles, lead to the inference that the kiva was incorporated into that part of the village by remodeling existing living rooms. Corroborative evidence of this is derived from the dates of charcoal. A series of pieces which cover a period of time between 1132 and 1231 are probably parts of beams that were originally in the rooms and subsequently re-used in the kiva. The latest dates ranging between 1293 and 1330 probably cover the actual construction time.

Thus, by the aid of datable charcoal, we know that this rectangular kiva was in use soon after 1300. It is too early yet to say when the transition from the round to the rectangular form took place. We gain a comparative idea from the two circular pre-Hawikuh kivas excavated by Hodge. Associated with these he found black-on-white, black-on-red often with white exterior patterns, and finely corrugated pottery.¹ These types correspond with those found in the lower stratum at Showlow, for which we gave a tentative minimum date of 1204. Hence, in ruins which were occupied between about A. D. 1200 and 1300, we might expect to find the transitional forms.

In its general features the Pinedale kiva has points in common with those uncovered by Hargrave² at Kokopnyama. The most outstanding difference is in the position of the platform. In the old Hopi kivas, built before the coming of the Spaniard, this feature usually occurs on the southerly side and across the shortest dimension of the chamber, whereas in the Pinedale kiva the platform is along the longest side to the east. The Pinedale kiva does not show the jogs at the platform end which Hargrave believes to be a characteristic feature of Hopi kivas. The rectangular kiva in Hawikuh which was abandoned and filled after the arrival of the Spaniards and later uncovered by Hodge³ also has the platform and the air duct on the south side.

Artifacts.—Comparatively few artifacts were recovered from the kiva. Two loom blocks (pl. 18, fig. 1) found on the platform at the

¹ Hodge, F. W., 1923, p. 28.

² See pages 103-116, hereinafter.

³ Hodge, F. W., 1922, pp. 9-10.

south end are considered in the description of stone objects. The occurrence of loom blocks in kivas is quite in keeping with modern Hopi practices.

No complete pieces of pottery were recovered. Fragments of several black-on-white ollas and one black-on-red olla are in the sherd collections. The black paint in all cases is a thin glaze. As the sherds from the kiva are wholly typical of those recovered from the other diggings in the ruin, we may omit the consideration of pottery at this point.

OBJECTS OF STONE

The stone implements recovered at Pinedale largely duplicate those found at Showlow. Certain objects, however, are worthy of special notice.

Metates and manos.—Concerning these, the description given of Showlow milling stones will also apply, although the correlation of the two types was less distinct. This is due in part to the limited number of rooms excavated completely and possibly to the fact that Pinedale ruin was abandoned a half century or more earlier than the Showlow pueblo, before the second type of grinders came into general use.

Mortar.—A mortar made of a shaped block of rhyolite was found in the refuse-filled room of test 1. The grinding cavity was approximately 6 inches deep and the same distance in diameter at the top.

Stone axes.—In the same room were found six or eight stone axes on which the cutting edge had been completely battered away or broken off. There were also present in the refuse several sandstone building blocks which bore grooves, transverse to the long sides. On one block the grooves were cut directly opposite each other on the two sides, obviously to facilitate the breaking of the stone at those points. The character of the grooves suggests that they were cut with stone axes, and if so, the presence of so many battered implements can be accounted for. All axes recovered, both broken and complete, are of the short-bitted, three-quarter groove type.

Stone hammer.—Only one stone hammer is contained in the collection. It is made of diorite and is $3\frac{3}{4}$ inches long. Unlike the stone axes, the hafting groove entirely surrounds the implement.

Loom blocks.—On the south end of the kiva platform were found the pair of loom weights pictured in plate 18, figure 1. Both are made of coarse-grained sandstone, the bases are flat, and the holes which engaged the loom stick are near the top of the blocks and less than an inch deep. The one block shows a long groove, evidently where weaving tools were sharpened.

Chipped implements.—A representative collection is shown in figure 13, *a* to *m*. Specimens *a* and *b* are chert knives which have been struck from a core much in the same manner as were the famous Aztec knives of obsidian. The triangular tool *c* is also of chert, $2\frac{1}{2}$ inches long, and was probably used as a knife or scraper. Objects *d*, *f*, and *g* are drills, the first one being of especial interest because of the bevelling on opposite sides of the point (see cross section *e*). The entering edge was thus made sharper than it would have been otherwise. Arrow points are of two types, plain (fig. 13, *h*, *i*, *j*) and tanged (*k*, *l*, *m*). The plain points usually have slight concave bases and are either short or long and slender, the latter being like the points commonly found in the Middle Gila. The bases of the tanged points are flat or nearly so.

Stone pipe.—The pipe represented in figure 13, *n* and *o*, is made of a very even-grained slatelike rock. It is $1\frac{3}{16}$ inches long and 1 inch in maximum diameter. All outer surfaces are highly polished. The bowl is formed by a conical drilling $\frac{3}{4}$ inch in diameter at the top which converges into a $\frac{3}{8}$ -inch boring at about the middle. The boring then extends from the juncture with the bowl proper to the base of the object. Just above the base on the outside a large chip was knocked off sometime during its use, for the broken surface shows much wear. A small hole perforates the side wall at this point which looks as though it had been made intentionally because of the small cup-shaped depression about the hole. As to its significance we cannot be sure. The small depression may have received the end of a stem fastened into place by means of pitch or some other substance. True elbow pipes, however, are the exception from southwestern ruins so that the trait in question may have served another purpose or the object may even have been discarded after the break occurred and put to some secondary use.

Pendant.—Figure 13, *p*, illustrates a plummet-shaped pendant recovered in room 2, test 1. It is $2\frac{3}{4}$ inches long, made of slate, and perforated at one end for suspension. A single notch on each side of the perforation represents the only efforts at incised decoration.

Ring.—The small fragmentary stone ring shown in figure 13, *q*, was probably intended to be worn by a child. The material appears to be the same as that of the pipe figured here. The protuberance suggests a copy of shell rings made of the *Glycymeris*, from which the beak is usually not removed.

Miscellaneous objects.—Crystals of quartz (fig. 13, *r*) are not uncommon in the ruins of central and southern Arizona. One was

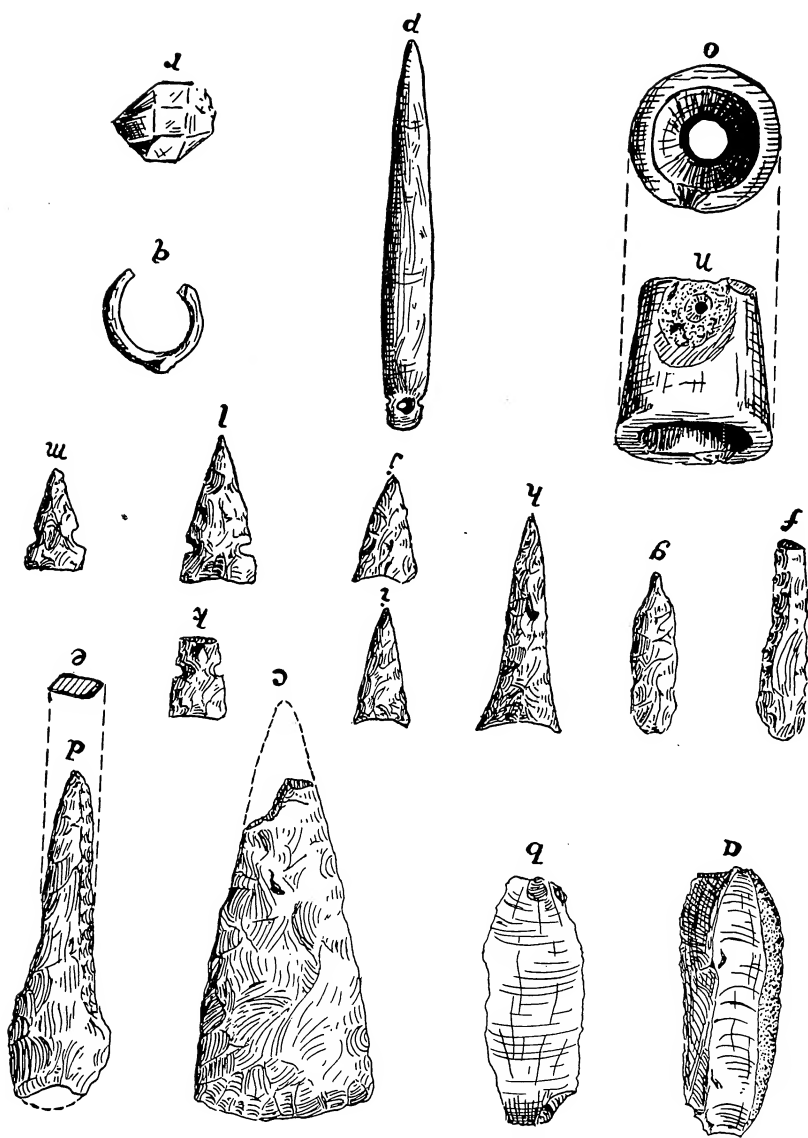


FIG. 13.—Stone objects from Pinedale ruin. (7/10 natural size.)

recovered at Pinedale. It was probably used as a fetish or formed a part of a medicine man's outfit. Crinoid stems and asbestos which were also found belong in the same class of articles.

Pigments.—Hematite is by far the most prevalent of pigment materials. It was found not only in its normal state, but also in micaceous and specular forms. Limonite, used in pottery making, kaolin, and copper carbonate were also found.

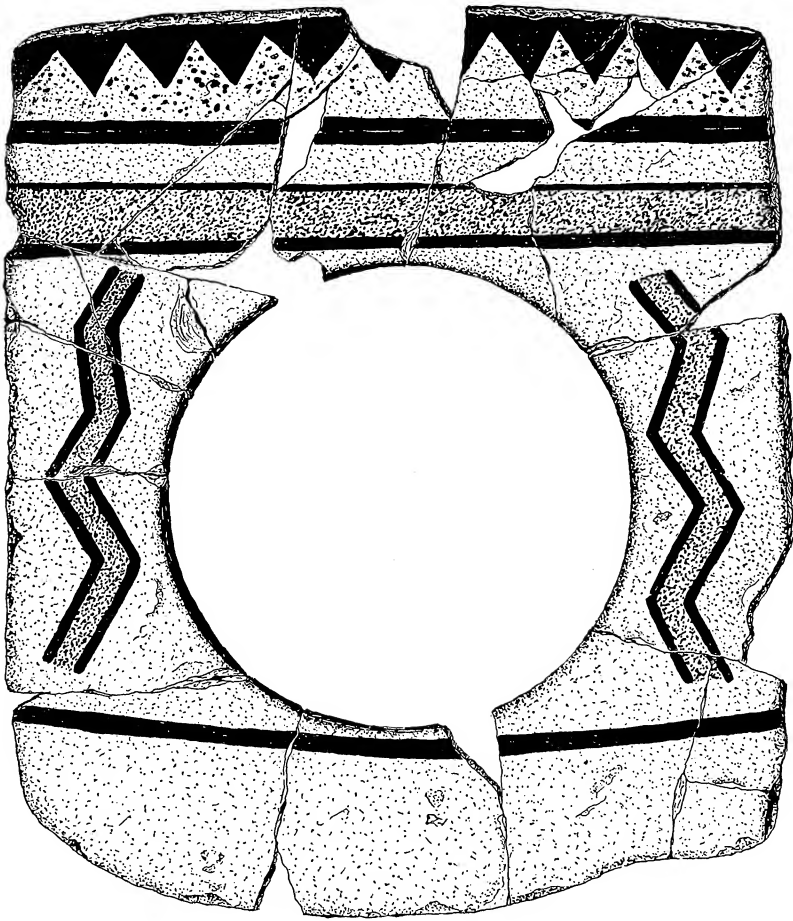
Painted stone slab.—Just above the floor of room 2, test 1, in rubbish which had been cast into the abandoned room were found the shattered parts of a painted stone slab. The restored object, pictured in figure 14, is made of a pinkish-colored sandstone. It measures 16 by 19 inches and is $\frac{3}{4}$ inch in thickness. The central portion of the stone has been neatly trimmed out to form a circular opening, 10 inches in diameter. Prior to its painting, one side of the slab was smoothed down to provide a better surface for the designs. A thick white kaolin wash was first applied, not only to the dressed surface but to the reverse side and the edges as well. The black and yellow pigments, both apparently of mineral origin, are evanescent. Nevertheless, in the best preserved parts, the paints are still vivid and full of life. Nowhere is the loss of figures so great as to cause doubt as to the continuity of design.

From the top of the slab extend a series of 11 black triangles, $1\frac{1}{2}$ inches high with apexes pointed downwards. Below these, traversing the full width of the slab, is a heavy black line made by two parallel strokes of the designer's brush. Still lower and just above the aperture is a yellow band 1 inch wide framed at both edges by narrow black lines. Underneath the upper framing line a dark red pigment shows up clearly, apparently a part of a previous design. To the right and left of the opening are free zig-zag patterns in yellow outlined in black except for the ends which are left open. The inner edge of the hole is finished with black pigment, now almost wholly obliterated. A single black line near the base completes the decoration.

As to its use, we believe it safe to say that the slab formed a part of an altar decoration or was otherwise used in religious rites. This inference is not wholly without foundation for painted slabs are still used by the Hopi Indians in the construction of the Antelope altar in the Snake Ceremonial.¹ Matilda Coxe Stevenson, in her treatise of Zuni mythology and ritual, records a ceremony² in which a wooden

¹ Fewkes, J. W., 1894, p. 43.

² Coming of Ko'loowisi (Plumed Serpent) and Involuntary initiation into the Ko'tikill. Twenty-third Ann. Rep., Bur. Amer. Ethnol., pp. 94-102, 1901-02.



KEY TO COLORS:



FIG. 14.—Painted altar slab from Pinedale ruin. ($\frac{1}{4}$ actual size.)

tablet bearing a large opening plays an important part (see fig. 15, introduced here for comparison). The tablet is ornamented with cloud terraces cut into the wood and outlined in color. In the center is a circular hole 9 or 10 inches in diameter through which the head of the fetish, Ko'loowisi (plumed serpent), is passed at specified times during the ceremony. The serpent effigy is about 8 inches in diameter. The tablet is either carried or used in a vertical stationary position.

It is not improbable that the stone slab found by us, is precursory to the wooden tablet in use today and that both are a manifestation of

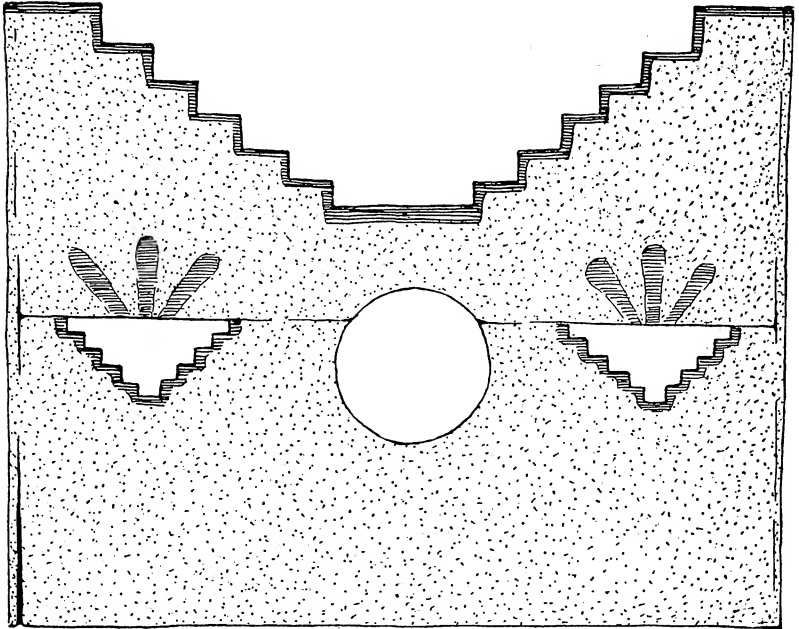


FIG. 15.—Wooden tablet used in a modern Zuñi ceremony. Introduced for comparison with figure 14. After pl. XIV, 23rd Ann. Rep., Bur. Amer. Ethnol., 1901-02.

a ceremony that has survived for 600 or more years. While the wooden tablet is the larger, the opening in both is almost identical in size. Applying the present Hopi interpretation of symbols, the black triangles on the ancient specimen are rain-clouds and the zig-zag patterns are symbolical of lightning. The modern tablet, however, does not have the latter symbols and the rain-cloud symbols are in forms of terraces, which is the common method of representation today. The change from stone to wood in the material of the slab would naturally be accompanied by certain modifying features, such as the increase in size and the cutout terraces of the present-day piece.

It will be noted that the base of the Pinedale slab is irregular and less carefully finished than the other three edges. It has been suggested that this unfinished side was imbedded in the ground to the depth of the black line during its use. This would hold the object in a vertical position so that a fetish such as the plumed serpent could be drawn back and forth through the opening with facility as in the recorded ceremony.

Relatively few painted slabs of this nature have been recovered, and those nearly all from the ruins in the Silver Creek drainage or its environs. Fewkes found an excellent specimen of rectangular form in a grave at the Chevlon ruin,¹ and Mr. Whipple at Showlow uncovered three or four well-made slabs in living rooms in his ruin. These are squared at the base and rounded at the upper end. Fewkes also notes the presence of one in a grave at Sikyatki,² which is, as far as we know, their northernmost occurrence. None other, however, has been recorded with the large opening.

A section of a charred timber found near the Pinedale tablet gave an unmistakable cutting date of A. D. 1286, which, with other specimens of comparable age from the same room, yields the approximate building date of the room. Consequently, the slab was discarded at a somewhat later time.

OBJECTS OF BONE

Awls.—Representative specimens are shown in figure 16, *a*, *b*, *c*. The first one is fashioned from the proximal end of an ulna; probably of the antelope, and *c* is a similar bone from some other animal.

Bodkins (?).—In his work at Chavez Pass ruin, Fewkes³ recovered 13 bone implements which he termed bodkins. One complete and one fragmentary specimen were found by us (fig. 16, *d* and *e*) at Pinedale. These and one figured from Chavez Pass by Fewkes display such similar characteristics that they must represent a type. They seem always to be made of about 6-inch sections of the metatarsal bones of the deer or antelope, including the joint. The maximum diameter of *e* is $\frac{5}{8}$ inch. The hollow of the bone is exposed for 2 inches below the blunt point and from there to the distal end the implement is highly polished. The articular faces of the joint were removed in order to maintain a more uniform diameter. Hodge⁴ pictures one from

¹ Fewkes, J. W., 1904, pp. 104-5, pl. XLVI.

² *Ibid.*, p. 162.

³ *Ibid.*, p. 94.

⁴ Hodge, F. W., 1920, pl. XX, a.

beams which would contribute to the historical sequence established shortly before from living trees in the forest about Flagstaff, Arizona. This chronology had been extended back to about A. D. 1260. Prehistoric beams which were brought in by the first field party and additional timbers sent in from Pueblo Bonito, Aztec, Mesa Verde, and other ruins, provided enough material for an extended examination. By 1927 two prehistoric chronologies independent of the historical ring-record had been evolved, the one from Pueblo Bonito and Aztec beams, and the second from timbers obtained in Citadel ruins, Mesa Verde, and others. In 1928 the Pueblo Bonito and Citadel chronologies were united by specimens from Betatakin and Keet Seel, two northern Arizona cliff dwellings. Thus a prehistoric but independent sequence of more than 580 years was established.

During early spring of 1928, the Second Beam Expedition started its search for timbers to link the two existing chronologies. A careful survey of the Hopi villages indicated that available beams there were not sufficiently old. Then, in order to discover such ruins as were neither too old nor too recent, recourse was taken to pottery to serve as a guide in the further selection of sites for examination. Preliminary studies by Doctor Douglass and Mr. Lyndon L. Hargrave of pottery types, in which a sequence of development was evident, and of associated dated timbers soon revealed the fact that for a certain form of decorated orange-red pottery no dates were available, whereas older and more recent pottery types could be assigned either relative or absolute dates. Supposedly, then, the undated orange-red pottery fell in the gap which separated the two chronologies. Hence, ruins where such pottery was plentiful might possibly supply the needed timbers.

A reconnaissance of sites in the Little Colorado River drainage in the spring of 1929 resulted in the selection of the following four ruins for investigation: Kin Tiel to the northeast of Holbrook, Arizona; Kokopnyama in the Jadito Valley; Showlow and Pinedale ruins in the pine forest of the Mogollon Plateau 50 miles south of Holbrook. On these sites the Third Beam Expedition centered its activities, Mr. Lyndon L. Hargrave working first at Showlow ruin with the writer and later in Kin Tiel and Kokopnyama, while the writer continued excavations in Showlow and Pinedale ruins. The findings of the two units of the expedition, collateral to the search for beams, are given in this joint paper.

The Third Expedition was successful in recovering timbers which tied together the historic and prehistoric chronologies, thus carrying

Hawikuh on which this modification was not made, although it is identical in every other respect.

The natural furrow on the reverse side of the complete specimen figured here, terminates in a foramen which passes through to the base of the bifurcation of the condyle. It is apparent that the cleft served a definite function. If used as a bodkin, the thread could either be inserted through the foraminal passage from the base and then knotted, or it could be brought back down and tied to the trailing end of the thread. In the latter case, the knot formed would slip

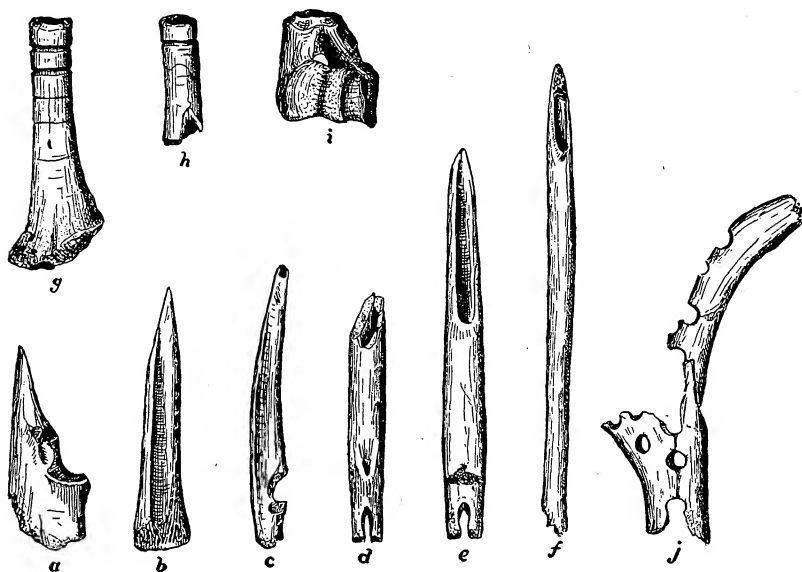


FIG. 16.—Pinedale bone implements. ($\frac{1}{8}$ actual size.)

conveniently into the cleft, thus eliminating the possibilities of its catching in other threads during operation.

Problematical tool.—The bone object in figure 16, *f*, is made of a tubular bone 7 inches long and $\frac{1}{2}$ inch in diameter. The pointed end is too soft and spongy to have been used as an awl or a punch.

Incised bones.—Specimens *g*, *h*, and *i* (fig. 16) are further examples of bones showing the cutting process. The first two were apparently segmented in the manufacture of beads but the last disjointments were not made. Example *i* is the discarded articular end of a leg bone.

Perforated antler.—A curious fragmentary piece for which we can suggest no utilitarian use is shown in figure 16, *j*. It is made of a forked section of a deer antler $5\frac{1}{2}$ inches long split longitudinally. The

more porous structural material on the inner side was removed, leaving the object a mere shell $\frac{1}{8}$ inch thick. The edges are trimmed down and smoothed well to the inner side of the antler. The shell bears evidence of 11 perforations which vary from $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter and which are placed at more or less regular intervals lengthwise along the object.

OBJECTS OF SHELL

Ornaments of sea shells were apparently not plentiful in pueblos of the Little Colorado drainage occupied in immediate pre-Spanish times, for the collection from Pinedale is sparse indeed. The genera represented are: *Glycymeris*, *Olivella*, *Conus*, and *Turritella*.

POTTERY

The few complete vessels and the great quantity of sherds recovered from the Pinedale ruin provide much needed data concerning certain aspects of the Silver Creek drainage pottery complex. It will be recalled that at Showlow, two levels of occupation existed and that the pottery types from the levels differed. The great mass of the Pinedale material is not analogous to the pottery of either of the Showlow levels, but nevertheless small proportions show unmistakable affinity with both. Hence, it is inferred that the period of greatest productivity at Pinedale was intermediate in relation to the two stages found in the former ruin. This relation was strongly suggested by a cursory test in the refuse heap where the supposedly later types were found to overlay the decorated orange-red phase of pottery recognized in the lower level at Showlow. Corroborative evidence was subsequently obtained from datable charcoal with which the dominant Pinedale types were associated. This association was provided by the refuse-filled room of test 1 and the kiva, both of which contained an abundance of sherds and ample charcoal. No doubt exists, therefore, as to the exact position of the Pinedale pottery in the sequence of development supplied by the two ruins.

As has already been mentioned, the most recent date from room 2, test 1, is 1286, and from the kiva about 1330, although the largest timbers of the latter gave earlier dates. Generally speaking, the construction period of these two chambers was nearly 100 years earlier than the last building period at Showlow. This would also place a corresponding difference of time on the pottery. To the lower level at Showlow we have tentatively given 1204 as the most recent date,

pending further examination of charcoal specimens. This, then, would signify an interval of fully 75 years between the earliest Showlow level and the major Pinedale occupation, and a difference of more than 75 years between the latter and the final Showlow occupation. Or, applied to pottery, which would be post-datum in all cases, the early Showlow wares would be 1204 (?), Pinedale about 1290, and late Showlow, 1375. Thus pottery types are not only assigned to their respective positions in the chronology but we also obtain a relative idea as to the amount of time elapsed during which wares acquired new traits or even nearly lost their original identity.

The Pinedale pottery which is treated in the following paragraphs was dominant in the late 13th and early 14th centuries. It can be broadly classified into the following types: black-on-white, black-on-red, black-and-white-on-red, plain, corrugated, and intrusive.

Black-on-white.—This type is apparently the result of a blending of the two black-on-white types observed at Showlow which evidenced both northern and southeastern contacts. In the Pinedale black-on-white, features of both older types were retained in modified form and new ones added producing quite a distinct pottery. In properly fired vessels, the paste is nearly white, otherwise it is darker in color. The tempering is almost pure pulverized sherds. In some cases there is a slight admixture of quartz grains and a few dark particles which may be basalt. The slip is thin, light gray in color, and the surfaces as a rule are well pebble-polished. The black paint is thin, either dull or a near glaze; when the latter, it is frequently translucent. Whether two pigments were used is doubtful, as in a number of pieces the dull paint may merge into the shiny, the difference being due apparently to the amount of paint present and the length of firing. Overfiring seems to have eliminated the incipient glaze qualities, as in extreme cases of overfiring the paint is a dull brown.

Ollas.—Judging by the abundance of sherds, black-on-white ollas were very common. The bodies are full and of greatest diameter horizontally; the orifices are small, seldom exceeding 5 inches in diameter. The neck is almost invariably vertical, in some cases rising at right angles from the body to a height of 1 to 2 inches. The lips are direct or slightly flared.

Decoration is applied in two zones, on the neck and on the major portion of the body. There seems to have been no fixed manner of decorating the necks. Sometimes the lip is painted black to which other elements are attached as in plate 19, figure 1, nos. 1, 2, and 3. Again the patterns may be banded horizontally, framed by narrow or

broad lines as nos. 4, 5, 6, 7, and 8, or they may be used as independent units as represented by no. 9. A similarity of vessel form and neck ornamentation will be noted between these ollas and the Four-mile polychrome ollas already described. Although black-on-white pottery was practically non-existent at the time the latter were made, the traits of likeness are probably survivals.

The body decoration consists of a single broad field beginning a few inches from the base of the neck and extending well down towards the bottom of the vessel. The field is emphasized by two heavy black lines which border it above and below. Set apart from these are narrow lines which form the actual framers of the patterns. In plate 19, figure 2, is given a representative collection of olla sherds. The designs are almost universally of contrasted heavy solid and hatched elements. The solid figures are either continuous triangles, terraced, or spiral elements (nos. 1 to 15). The latter, which always interlock with a hatched counterpart, it will be recalled, are typical of the Tularosa or Upper Gila black-on-white. Sometimes small fields are blocked off and treated as in nos. 16, 17, 18, and 19. The hatchwork is well drawn, much better than that of the black-on-white found in the lower stratum at Showlow. The framing and filling lines are of equal width and the latter are always straight. Sherds 20 and 21 show an unusually fine brush technique. The filling lines average 25 to the inch. Not infrequently the ends of the lines are so brought together as to give a herring-bone effect (nos. 22, 23, and 24). Perhaps most characteristic of the hatching is the change in direction of the fillers in almost every small unit (nos. 8, 9, and 25). Cross-hatching was found on one sherd only (no. 12).

Bowls.—Two types of black-on-white bowls are present. The one form is obviously related to the Showlow lower stratum black-on-white bowls and therefore older than the second type, which on stylistic evidence and nature of paint is judged to be contemporary with the ollas just described. They are comparatively rare, for their place was taken by the decorated redware bowls.

The bowls are small, very rarely more than 8 inches in diameter. The bottoms are rounded and the rims gently incurved. Both interiors and exteriors are polished and slipped. Ornamentation consists of all-over patterns on interiors, two of which are shown in figure 17, *a* and *b*, and independent elements on bowl exteriors (fig. 17, *c* to *h*). An unusual feature of the inner design in some vessels is its lack of a framing line at the rim. On several rim sherds, the lip is painted black in the manner of the Chaco bowls. As in the ollas the design

units are largely contrasted solid and hatched figures. The exterior patterns are either zoomorphic or geometric. The animal (fig. 17, *c*) and the combined birds, *d*, appeared on opposite sides of the bowl from which the pattern *a* was obtained. The tail feathers of the left bird of the combination represented in *e* joined the lip-line on one bowl and hung downward in the rakish angle shown. Figures *f*, *g*, and *h* are characteristic of the geometric units. A continuous decoration was noted in a single case only.



FIG. 17.—Black-on-white interior and exterior bowl decorations, Pinedale.

Black-on-red.—A true black-on-red was apparently little used although a polychrome on red was common. The sherds of the few black-on-red vessels at hand are probably the by-products of the early stages of the manufacture of polychrome ware. The paint is usually dull and the designs call to mind those found on the orange-red Little Colorado polychrome.

Black-and-white-on-red.—The polychrome on redware presents a considerable variety of features. Despite the variety, however, the

great amount of it has an unmistakable unity. On the basis of the chronological checks that have been provided by datable charcoal, this dominant form was in vogue before and after 1290. Those specimens that cannot be classed in the above group either approach the decorated redware at the lower end of the scale represented at Showlow, or they fall in the upper end of the sequence, also represented at Showlow. Since the predominating type of decorated redware at Pinedale is clearly a lineal descendent from the orange-red Little Colorado polychrome and adumbrates the development of Four-mile polychrome, we shall refer to it as a distinct sub-type, "Pinedale polychrome."

The base clay does not differ greatly in texture from that used in the black-on-white, although it usually burns darker. The tempering is almost pure ground sherds. In plate 20 a small amount of sherd tempering is shown (enlarged six times) just as it was washed from unfired clay. The largest fragment distinctly shows the scorings found in olla interiors. On other particles, bits of black-on-white designs may be seen, and the dark particles reveal either black paint or the red slip of former vessels. The fragments of the latter are rarely found in the paste of the black-on-white pottery. Quartz grains and other extraneous material occur in such negligible amounts that their presence is probably accidental.

The slip is fairly thin and varies in color from red to an orange-yellow, the former color being the more common.

The black paint on this pottery shows a gradation from a dull to a distinct glaze finish. The lack of a glaze technique in the lower Showlow level, which we have indicated as being older than the Pinedale horizon represented by this pottery, and the gradual shading into glaze decoration are strongly suggestive of the fact that paint compounding was passing through an experimental stage. This, however, does not imply local invention of glaze, as stimuli from a focus not yet determined could readily have affected ceramic decoration in Pinedale pueblo.

While the glaze generally resembles that of Four-mile polychrome, in the better examples it is more lustrous, often displaying greater relief, and usually freer of gritty particles. On firing, the glaze often ran, thus blurring the sharpness of the lines. These differences, however, because of the variability of the paint, can scarcely be used as determinants in distinguishing the types.

Quantitative determinations of the glaze materials by Mr. F. G. Hawley again show lead, copper, and some manganese to be present.

In a composite quantitative test, practically the same ratio of lead to copper obtained as was noted in the glaze of Four-mile polychrome. The greater copper content in both cases makes it quite evident that that element was added to the compound to produce the black color. The latter is usually opaque, the degree of opacity depending upon the thickness of the glaze. On some sherds, the glaze is brownish and translucent; and it may even have a purple cast which is possibly due to the manganese content. The occurrence of green glaze is noted rarely, in fact the few sherds which show it are considered to be indicative of Hawikuh relations where green glaze was prevalent.¹

In this connection we wish also to mention the occurrence of a dull brown paint on a few sherds. It appears to be much like that used on Jeddito yellow ware, although in the specimens under consideration it is present on normal Pinedale types.

The white paint is chalky, and as in Four-mile polychrome, it is much less tenacious than the black.

Ollas.—Ollas are represented by a few scant sherds which do not permit a full description. Their dearth can be explained by the abundance of black-on-white ollas. White is used sparingly, in fact in some cases it appears never to have been used, thus making a black-on-red product, although belonging technically in this group. Olla shapes agree with the standard black-on-white form.

Bowls.—These must have been very abundant for our collection has in it more than 150 rim sherds of individual vessels. The sizes vary from 7 to 10 inches in diameter, seldom larger. The bowls are conspicuously shallower than the preceding Little Colorado polychrome prototype. The rims are gently incurved and the lips are almost invariably rounded.

The variability of the decoration of bowls probably is the best expression of the transition through which this form was passing. To recount all the modifications would take us far afield for little gain, especially with rather limited data. It may be said, however, that the trend in design is distinctly approaching the results gained in the later Four-mile polychrome.

Interior patterns of four bowls are given in figure 18 with their corresponding exterior designs. In all but *d*, only black was used in the interior while white was brought into play on the outsides. Such is the case with approximately 90 per cent of the vessel fragments in the collection, while in the remaining 10 per cent white was employed in the capacity of outliners for the heavy black elements. In pattern *a*

¹ Hodge, F. W., 1923, p. 29.

a circular area in the bottom of the bowl is unpainted; in *b* the field is divided into quadrants, both designs have broad rim bands. In *c* the design area is tripartite and lacking the border at the rim. Two opposing quarters in *d* have a white background on which the black



FIG. 18.—Interior and exterior bowl decorations of Pinedale polychrome.

elements are superimposed. The use and non-use of rim bands is about equally divided.

Additional designs appearing on bowl exteriors are shown in figure 19. Figures of birds (*a*, *b*, and *c*) and dentate elements (*d*, *e*, and *f*) are characteristic. The latter are probably conventional adaptations of bird wings, for this is well illustrated by *g* where one such



1. The Pinedale ruin from the north. The central depression is the plaza.



2. A typical section of Pinedale masonry. The second slab below the whisk broom is 4 feet long.



1. Pinedale. Dr. A. E. Douglass pointing out beam EH-56 *in situ* which dated A. D. 1286, found in P1-R2.



2. Specimen EH-68 (below whisk broom) in position on platform of Pinedale kiva.



1. Pinedale. P1-R2 after excavation. Note bulge in far wall and the doorway on level with the floor.



2. Pinedale. The offset in the south wall of the kiva and the suggestion of a banquette extending from the offset left to the platform.



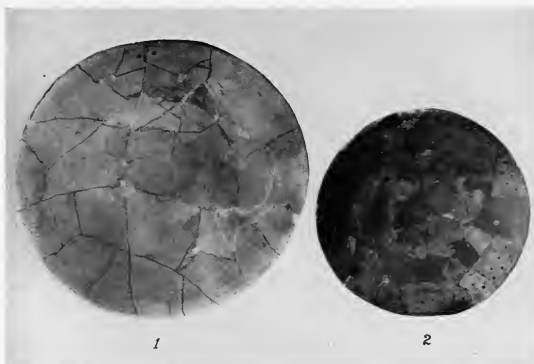
1. The Pinedale kiva looking south. Note the collapsed platform at the south end.



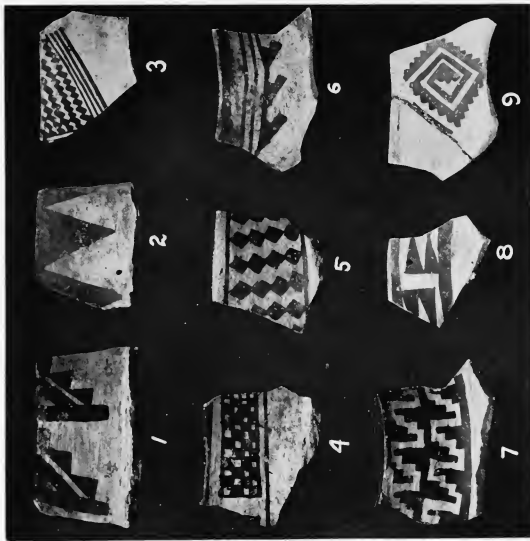
2. Pinedale. East view of kiva looking into ventilating shaft and firepit.



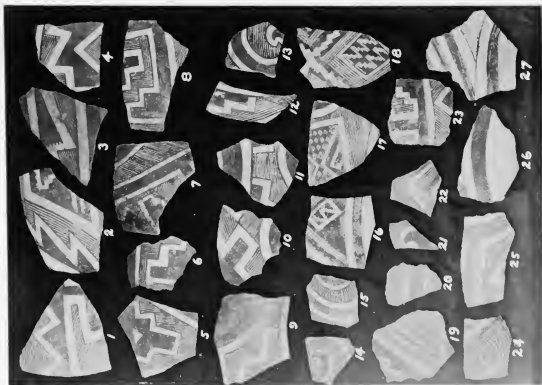
1. Loom blocks found in the Pinedale kiva.



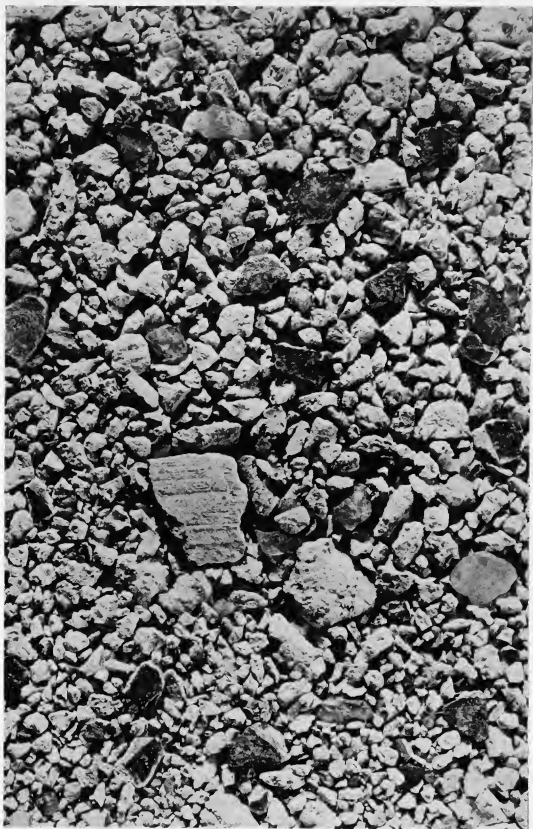
2. Platelike vessels from Pinedale. (Diameter of figure 1, $16\frac{1}{2}$ inches.)



1. Black-on-white olla rim sherds, from about 1200 horizon, Pinedale ruin.



2. Black-on-white olla sherds from about 1200 horizon, Pinedale ruin.



Pinedale. Pulverized potsherds used as tempering material. Note particles showing former designs. (Enlarged six times.)

figure occurs in combination with what appears to be a bird's beak as it is often drawn. The last three designs *j*, *k*, and *l* (fig. 19) are continuous and placed from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch below the rim. Other continuous patterns as in figure 17, *b*, begin to take on the appearance of the exterior decoration of Four-mile polychrome (see fig. 8).

Plain ware.—The utter lack of plain cooking vessels is one of the surprising features of the Pinedale pottery. Decoration was lavished on practically every vessel made except the corrugated. The only other unpainted vessels in the collection are the shallow platelike objects pictured in plate 18, figure 2, which we believe were used as bases in

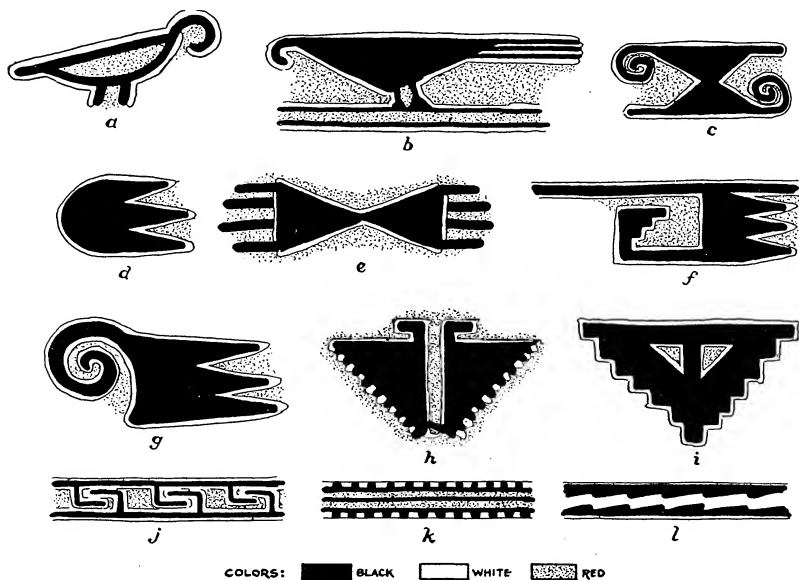


FIG. 19.—Exterior designs of Pinedale polychrome bowls.

the process of manufacturing pottery. To the depressed surface of the smaller plate, a small quantity of tempered clay is still adhering. Both vessels are unslipped but highly polished on the inner surface. The exteriors are rough, but show no corrugations. The larger specimen 1 is 16 $\frac{1}{2}$ inches in diameter and 4 inches deep while 2 is 11 $\frac{3}{4}$ inches in diameter and 1 $\frac{1}{2}$ inches deep. About the periphery of the latter are two rows of perforations $\frac{1}{2}$ inch apart. The holes were made from the inside outward before the surface was polished, for the latter process nearly closed some of the perforations. Similar objects have been recovered in Marsh Pass¹ and in the old Hopi ruins. As to the significance of the marginal perforations, there

¹ Kidder, A. V., and Guernsey, S. J., 1919, p. 143; also by Doctor Cummings.

seems to be no satisfactory explanation, although in the vessel illustrated here they appear to have served no other purpose than ornamentation.

Corrugated.—Corrugated ware does not differ appreciably from that found in the lower horizon at Showlow. Finely corrugated ware is almost entirely lacking at Pinedale.

MISCELLANEOUS POTTERY OBJECTS

Knobbed vessel.—Figure 20 illustrates a fragment of a small globular black-on-white vessel found in test 5, Pinedale ruin. It has, in addition to the paint decoration, two horizontal rows of protuberances



FIG. 20.—Portion of a knobbed and painted vessel. (Actual size.)

spaced at about half-inch intervals. They were made by sticking small pointed pellets of clay to the vessel wall and emphasized further with touches of black paint. Broad black lines border the two rows of knobs.

Vessel fragment showing molded hand.—The object pictured in figure 21 illustrates another attempt at adding plastic features to a vessel exterior. Here a crude four-fingered hand is portrayed, evidently a part of a more elaborate production. The top of the hand and fingers originally were painted black but the paint is now almost obliterated. The thickness of the sherd, excluding the hand, is $\frac{3}{8}$ inch, and, judging by its curvature represents a vessel that was fully a foot in diameter.

Pottery scrapers.—In addition to several pottery scrapers similar to those found at Showlow, one was recovered in Pinedale ruin that

the tree-ring calendar back to A. D. 700. Beam HH-39, found at Showlow, proved to be the key beam that converted the relative dating series of more than 580 years into the absolute chronology by confirming what was found to be a short over-lap instead of a gap. The outer rings of the specimen in question could be read to about A. D. 1380, while its central ring dated A. D. 1237. The innermost rings coincided with the last rings of the prehistoric chronology and the outer rings were readily identifiable with the 13th and 14th century records of the historic sequence. Subsequent excavations yielded additional timbers which covered practically the same period, thus substantiating the record of the key log and relieving all feeling of uncertainty that might accompany the placing of so much reliance on a single beam.

The relation of tree-ring studies to archeology is obvious with the realization that beams showing true outsides found in ancient dwellings will not only give the cutting date of the timber, but will also strike near the time of the construction of the dwelling. Eventually we may be able to interpret the entire development of Pueblo architecture in terms of actual dates and even trace minor changes of architecture within a single pueblo. Needless to say, the artifacts associated with dated ruins become more instructive in view of the added data concerning their antiquity.

The future of tree-ring research as applied to archeology is extremely promising. The present status of the study, which has enabled the dating of approximately 40 pre-Spanish ruins, is the bare beginning of what will eventually be accomplished. There remains yet the dating of many ruins which have escaped thorough investigation; the backward extension of the tree-ring calendar beyond the present terminal date of A. D. 700, so that structures older than Pueblo Bonito may be assigned to their respective places in the scale of development; and the dating of the many impressive ruins in the Rio Grande drainage, New Mexico, which, as yet, have gone undated. Other phases of the problem, now unthought of, are certain to follow.

In the following report, an attempt is made to correlate the archeological observations derived incidental to the search for charcoal with the data obtained from the charcoal specimens themselves. For the use of the latter information I am deeply obligated to Doctor Douglass. In view of the rather limited excavations, it is desirable to point out the trend of cultural development in the region under consideration rather than to venture many positive conclusions. Furthermore, it is too early yet to speak with finality concerning the complete relations of the datable charcoal to the ruins, for that depends upon continued research.

is of unusual interest. It is made of the handle and part of the body of a small black-on-red pitcher (fig. 22). The handle is decorated in imitation of an animal. Two small projections at the rim, each tipped with black, are probably intended to portray the eyes. Fewkes¹ recovered two black-on-white pitchers in Kin Tiel, the handles of both showing similar treatment.

Intrusive pottery types.—Fragments of vessels which are characteristic of the Middle Gila were found in considerable numbers in Pinedale ruin. These occur contemporaneously with the types of pottery described in the preceding pages. The abundance of this non-local ware need not imply, however, that all of the vessels were

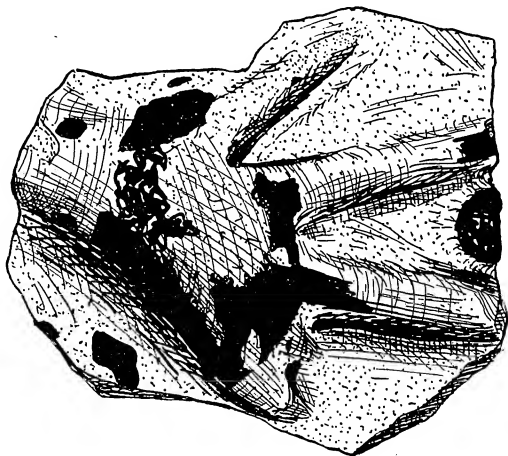


FIG. 21.—Vessel fragment showing molded hand. (Actual size.)

actually acquired in trade relations, but rather that some of it was made locally in imitation of trade pieces or possibly even made by women coming from the southern district. Examination of the sherds leads to a conviction that such was the case for there are some specimens identical in every respect with vessels of similar style found on the Gila, while others show local sherd-tempered paste and local treatment of the designs.

The fragments fall into two groups: (a) those of bowls with black-on-white interior decoration and plain red or brown exteriors, and (b) fragments of bowls with black interior designs on red. The former type is well known and was found to be a comparatively late arrival at Casa Grande by Mr. H. S. Gladwin.²

¹ Fewkes, J. W., 1904, pp. 130-131.

² Gladwin, H. S., September, 1928, p. 20.

The second group is perhaps less known and as far as we can find, has never been described. Vessels of the same character have been recovered by Dr. Bryon Cummings with cremations in ruins on the Gila near San Carlos. Technologically it is identical with the two-color decorated ware except that a light red or salmon-pink slip was substituted for the white. Sometimes the slip was dispensed with, the natural color of the base clay serving as the background.

Hopi relations are shown by two fragmentary vessels of Jeddito black-on-yellow, one found near the surface and the other with a late burial made in the fill in a room. Two bowls of Pinedale polychrome

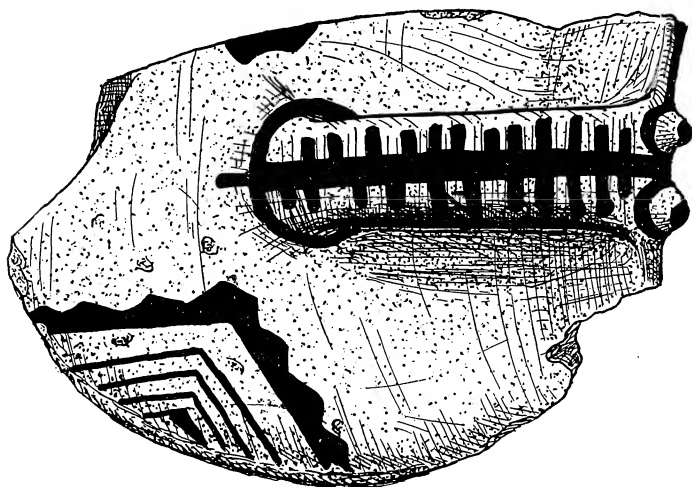


FIG. 22.—Pottery scraper made of a black-on-red pitcher fragment. (Actual size.)

were found with the latter. Sherds of local imitation of Hopi yellow pottery, such as noted from Showlow, were not encountered here.

Contacts with old Zuñi ruins are not clearly indicated. Hodge's early Hawikuh Period C may be represented by a few fragments of a black-glaze-on-white olla.

THE BAILEY RUIN

During the course of excavation at Pinedale, we were informed of a ruin of considerable extent, situated in the Phoenix Park district, approximately 15 miles west and slightly north of Pinedale. The ruin stands on land owned by Mr. Geo. W. Bailey and locally is known as "Bailey's ruin," although some years ago it was known as the "Stott

Ranch ruin.”¹ In the late '80s the ranch was a notorious center from which horse thieves operated.

The ruin is located a few hundred yards southwest of the ranch buildings on the south edge of a long narrow park. The higher part of the ruin is covered with large pine trees.

A sherd collection made on the first visit to the site contained, among other types, a small proportion of the black-on-orange-red phase of pottery which fell in the gap-period of the Douglass chronology. On these grounds a day was spent at the close of the field-work in putting down three tests to ascertain whether or not a prolonged search for charcoal would be justifiable. The three pits, sunk at widely separated points in the northern extension of the ruin were unproductive of charcoal, consequently further search was postponed.

The pottery at this site indicates contemporaneity with Pinedale. Late 14th century types are but meagerly represented, hence its history may be quite analogous to that of Pinedale.

The Bailey ruin is one of the few, if not the only one, of considerable size in this region which has not been pilfered. Less than a half-dozen rooms have been touched, and the trash mound which is extensive and superficially appears to have depth, is undisturbed. From it much valuable stratigraphic data could undoubtedly be obtained which would greatly clarify and contribute to the present meager knowledge of human activity in the Silver Creek drainage.

CONCLUSION

We may now turn our attention away from the purely archeological aspects of the problem and consider it on an historical basis. Dates obtained from charcoal have already been given in the several sections of this paper, but there still remains the formulation of the process of development as shown by the present data. Spier and Hodge² have contributed materially to the establishment of the sequent stages of progress in this southern part of the Little Colorado drainage. The present reconstruction follows the general outlines set by the above investigators, but it applies only to the area drained by Silver Creek and its immediate environs in which some local variations have been noted.

¹ So named by Fewkes, who visited it in the summer of 1897 but did not excavate due to its isolation from supplies. Fewkes, J. W., 1904, p. 167.

² Spier, L., 1919; Hodge, F. W., 1923; note also Kidder's résumé, 1924, p. 94.

The Showlow ruin and possibly the one at Pinedale originated as small, loosely arranged buildings of probably not more than a dozen rooms. The remains of small sites of this description are plentiful in the region, especially along Showlow Creek. Their existence is indicative of a time when the settlements were generally small; the buildings were apparently not more than one story high and not closely knit. Tests in the northeast section of the Showlow ruin brought to light the foundations of one of these early settlements. The associated pottery types are black-on-white of San Juan (Chaco) affiliation, a very small percentage of redware with dull black interior and white exterior designs, and corrugated ware of relatively fine technique. These types are in marked agreement with those found in the small communities not far afield.

Judging by the pottery found in them, the small sites seem to have been evacuated almost simultaneously not long before the decorated redware became plentiful. Such concordant action is almost certainly the result of a disorder, the cause of which might well be attributed to the influx of nomadic and predatory people. Just when this disorder, or whatever it was that motivated the change, took place, we cannot yet say positively as none of the small sites has been explored for wood specimens. However, on the strength of the evidence secured in the lower level at Showlow, we venture the assertion that it was prior to A. D. 1200, for by about that time a greater amount of decorated redware and black-on-white of southern derivation is present. The paucity of these types in the small ruins would place their abandonment at a somewhat earlier time.

The concentration of the population in a few chosen pueblos introduced problems before unknown. As a consequence, the movement was attended by an accelerating force and a stimulus in the development of certain cultural traits. Extensive structural additions to the villages were demanded in order to accomodate all. Rooms were compactly arranged side by side and one above the other. Thus, it seems, the true pueblo came into existence in this region.¹ In ceramics, the few types which showed exterior influences were modified and fused and native types underwent relatively rapid changes to produce highly localized forms.

We find that the Showlow and Pinedale pueblos attained their largest size during the 14th century. The Pinedale pueblo experienced a major building period in the last decades of the 13th century but

¹ The pueblo idea, however, was not original, for structures of that type had been in existence for several hundred years previous in the San Juan.

apparently grew very little after that time. A century later, the Showlow pueblo was still growing, then suddenly stopped and from all indications was involuntarily abandoned. The highest refinement in masonry is shown at Pinedale in the rooms dating towards the close of the 13th century. Several shallow late walls at this site and all of the late 14th century structures at Showlow indicate a marked retrogression in construction. This is in accord with the general trend of Pueblo architecture manifested in the ruins built after the Great Period (Pueblo III). The length of the occupation at Showlow, which Hough believed to be short, is approximately 200 years as indicated by datable charcoal, but, since charcoal is lacking from the old northeast quarter which appears to be still older than the first definite Showlow horizon, we can assume a considerably longer period of occupancy. The greatest exodus at the Pinedale pueblo seems to have taken place early in the 14th century, at least before the development of Four-mile polychrome in its fullest form. The presence of a small percentage of the latter indicates, however, that a few individuals remained or returned subsequent to the abandonment.

Concerning the development of ceramics during the lapse of time represented by the present diggings, we find it necessary to correlate the data from both ruins in order to place the material in its sequential order. Three periods are registered which pass almost imperceptibly into each other. For the oldest horizon represented in tests 1, 2, 3, and 12 at Showlow, we have ascribed the tentative date of 1204; the second period manifested at Pinedale is 1290; the last phase at Showlow again, is 1375. First period forms of decorated ware are black-on-white which evidences foreign influence, and black-on-orange-red with white exterior designs, possibly of local derivation. This phase is probably broadly coincident with Hodge's pre-Hawikuh Period A.¹ It is worthy of note that the pottery of Chaco traits existed in this region possibly a hundred years after the Chaco Canyon culture ceased.² This is a good example of the survival in marginal areas of a trait which has died out in the center of origin.

By about 1290 the black-on-white, which was still abundant, had been more or less standardized into a form typical of the region but with the retention of definite traits exhibited in black-on-white found along the Salt River. It represents probably the last survival of black-on-white pottery south of the Santa Fe railroad. Decorated redware

¹ Hodge, F. W., 1923, p. 29.

² Judd, N. M., (in preparation).

shows a signal increase in quantity and several rather abrupt departures from features of the lowest horizon form. The bowls have become shallower, black plays an important part in exterior designs, and white sometimes in interior patterns. This form, referred to as Pinedale polychrome, has been shown to be antecedent and leading up to the typical Four-mile polychrome as here described. Its time of appearance is certainly not later than the last decades of the 13th century. This period also marks the invention or the introduction of black glaze paint which was used on both white and red wares, without an appreciable change in decorative style. During this second stage practically all of the pottery made, except the corrugated, was decorated. External relations were largely to the south with the people of the Middle Gila, and to a lesser degree to the east with old Zuñi and north with the old Hopi cultures.

By 1375, black-on-white pottery was practically non-existent. Its rather sudden disappearance may be explained by an intense local specialization of the decorated redware or Four-mile polychrome. The basic differences between the latter and its ancestral form are: a deeper red slip covering the paste; a poorer, gritty black paint but still basically a glaze; exterior continuous patterns in black and white; and generally unbalanced geometric units and life patterns on the interior fields of design, also executed in black and edged with white. Guided by Fewkes' finds at Four-mile ruin, we may say that the use of life patterns in bowls became more prevalent in the most recent forms of Four-mile polychrome. Relatively few are noted in bowls from the Showlow ruin and more from Four-mile which was abandoned after Showlow. The last phases of Four-mile polychrome at its type site are contemporary with Jeddito black-on-yellow and the three-color Tonto polychrome,¹ and then, rather suddenly apparently, it passed out of existence. Interrelations at the close of the last period were increasing with the Zuñi and Hopi areas although contacts with the Gila are still represented.

At this point it is well to insert a brief discussion of the age of lead glaze in the Pueblo region in the light of the expedition's discoveries. Some investigators are of the opinion that the glaze technique is acultural and not indigenous; that it was obtained from the Spaniards or even from Mexico later than the Conquest. Other explorers, however, have given glaze decoration a pre-Spanish status on the basis of stratigraphy. To this latter contention our evidence is directly corroborative. Not only does stratigraphy at Showlow and

¹ The Medallion, 1930, pp. 8-9, pl. VI.

Pinedale ruins, both totally abandoned before the advent of the Spaniards, uphold this, but the newest science for age-determination of southwestern ruins, namely, dendro-chronology, confirms the stratigraphic claim. And more, it hints strongly at the length of time that elapsed between the development of a glaze technique and the first Spanish contacts.

As previously suggested, the apparent gradual merging of the dull black paint into one with glaze properties on Pinedale polychrome does not bespeak a sudden appearance of glaze but rather of a slow development in or not far from the center of invention. The beginnings of Zuñi and Pinedale glaze development appear to parallel each other, both seemingly responding to the same stimulus. That this stimulus was pre-Spanish and consequently native, is indicated by the presence of lead glaze on Pinedale polychrome coming from the late 13th century horizon at Pinedale, and the continuance of its use on Four-mile polychrome from the upper Showlow level dating 1375. Thus, glaze paint was known and used fully 200 years before the arrival of the Conquistadores. Indeed, it had already become decadent by the time of their arrival and soon after the Pueblo potters reverted completely to the dull, flat colors.¹

These facts do not agree with Hough's statement, therefore, when he says² " . . . that the Pueblo potter could take the step to glaze which appears to have arisen in the line of smelting metals is doubtful." Or, " . . . a critical examination of the question as to the use in prehistoric times of lead glaze decoration by the Pueblo Indians brings forward a number of points which seem to render the assumption doubtful if not improbable." He states further that glaze decorated wares are never associated with black-on-white. Numerous tests in Pinedale ruin always showed glazed wares and black-on-white to be synchronous, the latter also frequently, but not always, decorated with glaze. This contemporaneity of glaze and black-on-white wares either signifies that glaze was invented earlier than has been supposed, or, that the Pinedale black-on-white was a late survival.

Additional checks on the age of lead glaze may be had by the presence of intrusive glazed sherds in ruins outside of the glaze area. Thus, Four-mile polychrome sherds and Zuñi glazes found in Kokopnyama which has yielded no trace of Spanish influence and no datable wood more recent than A. D. 1416, and the occurrence of Four-mile

¹ Kidder, A. V., 1924, p. 91.

² Hough, Walter, 1928, pp. 248-249.

polychrome at Casa Grande ruin,¹ show that glazed pottery entered the trade channels and was carried far afield before 1520.

The arguments for a post-Spanish origin for glaze in the Pueblo region can hardly be considered tenable in view of the unerring evidence of stratigraphy and dendro-chronology combined.

It is of especial interest to note that in the Pinedale horizon two types of glaze occurred contemporaneously for a short time. The indications of Mr. Hawley's paint tests are that the redware invariably carried a lead glaze with a relatively high copper content, while the black glaze on white ware contained neither lead nor copper but was apparently of a salt compound. The latter was earlier than the lead glaze, for a small percent of black-on-white pottery from the lower Showlow stratum bore a black shiny paint, foreshadowing its later development. It seems to have passed out of existence, however, with black-on-white ware, being survived by the lead glaze. It may therefore have contributed in some measure to the development of the superior lead glaze paint.

The sequential development of the decorated redware of the first Showlow horizon to Four-mile polychrome of the final stage makes an interesting disclosure concerning the spatial element involved in ceramic progression. If the date ascribed to the oldest culture period is correct, namely, A. D. 1204, then approximately 200 years elapsed to effect the changes. The transitional form, Pinedale polychrome, comes about midway between the two terminal dates. Thus approximately each century, basic changes were made in pottery, so that by the end of a 200-year period, the resultant form had but little resemblance to its earliest forerunner. These figures are not given as generalities, as the rate of development undoubtedly depended upon the nearness to a manufacturing nucleus and upon external influences, but they seem to hold true for the region under consideration.

The accurate date-checks of Four-mile polychrome which have been secured make it invaluable as an indicator of time in those ruins where it is found. Thus, Four-mile ruin, a site near Shumway, Homolobi, Chavez Pass, Cheylon, and a few others were occupied as late possibly as the beginning of the 15th century. The occurrence of Four-mile polychrome in Gila Pueblo, Globe, and at Casa Grande, west of Florence, shows trade relations and, hence, life in those sites as late as about 1400. Mr. H. S. Gladwin's recovery of four or five sherds of this ware in the Late or Classic horizon at Casa Grande is convincing as to the recency of occupation there.

¹ The Medallion, 1929, pl. IV.

The following composite tabulation of the several recognized horizons and the related local ceramic types in Showlow and Pinedale ruins is necessarily incomplete and must be enlarged upon at a subsequent time.

First Horizon: A. D. 1204 (?) Showlow

Black-on-white very abundant; shows both Chaco Canyon and southern affinity.

Black-on-orange-red with white exterior patterns abundant; designs usually balanced solid and hatched elements in dull paint. (Pl. 8.)

Corrugated ware crude to fine, some with exterior white decoration. (Pl. 9, fig. 1.)

Second Horizon: 1290 ± Pinedale

Black-on-white abundant; vessel forms mainly ollas; decorations are distinctly local but retain certain foreign features; thin black glaze paint commonly used. (Pl. 19, figs. 1 and 2, text fig. 17.)

Pinedale polychrome very abundant, appearing almost exclusively as bowls; is directly derived from the first horizon orange-red phase; white seldom used on interiors and almost invariably in association with black on exteriors in independent units or continuous patterns; interior designs geometric and balanced but of great variety; black paint is preponderantly a lead glaze, seldom merging into other colors. (Figs. 18 and 19.)

Corrugated ware crude and not very abundant.

Third Horizon: 1375 ± Showlow

Black-on-white ware rare or absent, apparently no longer in vogue.

Four-mile polychrome predominating decorated ware; slip a darker red and generally softer than antecedent stage; glaze paint is decadent, may lack luster and be vitreous and gritty; exterior patterns are in black and white and almost without exception continuous; interior designs are also in black and white in specialized geometric and zoomorphic elements. (Pls. 11 and 12.)

Corrugated ware more abundant, some shows horizontal flutings or ribs not evident before. (Pl. 9, fig. 2.)

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The two ruins, the first located at Showlow and the second at Pinedale, Arizona, and the artifacts recovered from each, are considered in the order named. Since both ruins are situated on privately owned land, we are indebted to the liberality of the owners in permitting us to work. At Showlow we wish to thank Mr. Edson Whipple who owns the major part of the Showlow ruin, Mr. W. Whipple and Mrs. L. Stratton, owners of the extreme south and north ends of the pueblo, respectively, for their cooperation. To Mr. Owen Cheney we wish also to express our appreciation for permission to conduct work in the Pinedale ruin. A single day was spent in investigating a large ruin on the ranch of Mr. Geo. W. Bailey, located about 15 miles northwest of Pinedale. Although no charcoal was obtained, the ruin is a most promising one for future archeological work. The very commendable attitude of the owner to prevent its despoliation by pot-hunters is largely responsible for its good condition.

The Showlow and Pinedale ruins are situated in the area drained by Silver Creek, one of the important southern tributaries of the Little Colorado River. The sources of this stream are in the northern slopes of the White Mountains almost due south of Holbrook. It flows northward past Taylor and Snowflake, Arizona, and then becomes confluent with the Little Colorado about two miles south of Woodruff. Its principal tributary from the west is Showlow Creek, about three miles south of Taylor. Cottonwood and Morterson Washes are also contributory from the west. Eastern affluents are all of a minor character. The area drained by the Silver Creek system embraces approximately 800 square miles. The land ranges from about 8,000 feet elevation on the south to 5,000 feet at the Little Colorado on the north. Vegetation varies from heavy pine timber in the high altitudes to treeless expanses in the lower regions. Both ruins investigated lie in the southern timbered part of the drainage area. (See map, fig. 1.)

SHOWLOW RUIN

Showlow ruin is located about 55 miles south of Holbrook in Showlow, Navajo County, Arizona (fig. 1). It is situated on a low elevation marginal to a narrow valley formed by Showlow Creek which lies less than a quarter of a mile to the east. The surrounding country is thickly wooded with western yellow pine, several species of juniper, and oak. The proximity of the ruin to pine was one of the determining factors in its selection for this investigation, for the precision and sensitiveness with which pine registers the passage of years by annual rings makes it the ideal timber with which to work in build-

EXCAVATIONS AT KIN TIEL AND KOKOPNYAMA

By LYNDON L. HARGRAVE

Following a superficial examination of several ruins in the Little Colorado River drainage early in the summer of 1929, the Third Beam Expedition of the National Geographic Society centered its initial search for datable fragments of charred ceiling timbers in the two pre-Spanish Indian villages at Showlow and Pinedale, Navajo County, Arizona. After working a few weeks with Mr. Haury at the former site the present writer proceeded to Kin Tiel ruin; later, to Kokopnyama.¹ Since both these villages lie north of the Little Colorado and show definite Hopi affinities, the observations presented herein may prove helpful to those archeologists interested in that period of Hopi history which shortly preceded the coming of the Spaniards in 1540. The writer begs to remind his readers, however, that the 1929 explorations were undertaken solely for the purpose of collecting ancient beams that might contribute to the completion of the Douglass tree-ring chronology and thus disclose the actual age of Pueblo Bonito, in Chaco Canyon, New Mexico. The data herein recorded are, therefore, to be regarded merely as by-products of the expedition.

KIN TIEL RUIN

Wide Ruin, or Kin Tiel as the Navajo call it, is a well-known ruin situated on an eastern tributary of LeRoux Wash 18 miles north of Chambers, Arizona. On early maps the ruin is indicated as Pueblo Grande² and was first given prominence through the work of Mindeleff³ and Fewkes.⁴ At the time of their respective observations, the old village must have presented an inspiring sight, for many portions of its broken walls were standing two stories high. Today these have been reduced to a low mound which, from its shape, is sometimes referred to as "The Butterfly Ruin." The appropriateness of this term is at once apparent from the accompanying ground plan (fig. 23).

¹ The author wishes to thank Mr. E. C. Greene, Jr., for his services as field assistant, and for drawing the plans.

² 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 91.

³ 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7. A study of Pueblo architecture, Tusayan and Cibola, by Victor Mindeleff.

⁴ 22nd Ann. Rep., Bur. Amer. Ethnol., part 1, 1900-01, p. 124.

Unlike other known ruins in the district, the outer wall of Kin Tiel was unbroken save for narrow passageways.¹ Terraced dwellings looked down upon open courts as in the case of Pueblo Bonito; these courts were separated by a stream channel which appears to have been crossed by extensions of the outer wall of the village, if we may judge from Mindeleff's carefully prepared plan.

Toward the west end of the pueblo and crossed by the wash, or stream channel, a masonry-walled spring furnished the village folk with an abundance of clean pure water. Today this spring is used by Mrs. D. W. Balcolm,² the present owner, who has installed a pump to supply domestic water for her trading post, as well as water for the flocks of Navajo sheep that range the district. When Mindeleff made his reconnaissance the location of this spring was unknown,³ and he comments upon the apparent lack of an adequate water supply. The spring was discovered about 40 years ago by Mr. Hawthorn, who settled and built a trading post nearby, and who unfortunately destroyed most of the outer wall of the ruin in his search for suitable building material. This destruction has been completed within the past two years, for the foundation stones at Kin Tiel were quite naturally preferred in the construction of modern dwellings. In consequence, no primitive masonry today stands above ground. The Butterfly Ruin has been levelled utterly; its once terraced chambers have been reduced to a low, wide-spread mound of sandstone blocks and adobe mortar.

KIVA KT-I

Since the sole object of the National Geographic Society's 1929 expedition was to secure datable beam material, and since previous experience had taught us that the largest beams were likely to be found in kivas, the well-known subterranean ceremonial chambers of the Pueblo tribes, our initial efforts in Kin Tiel were directed toward discovering burned rooms of this type. A large circular depression was therefore chosen for excavation. This, because of its location and diameter, was thought to indicate a kiva of Pueblo Bonito type. Certain local resemblances to Bonitian architecture and pottery had greatly influenced this belief, in spite of the traditional connec-

¹ 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 92.

² We wish to acknowledge Mrs. Balcolm's willing cooperation in the purpose of the expedition, her generous permission to excavate and her warm hospitality which was extended to the members of our party.

³ 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 92.

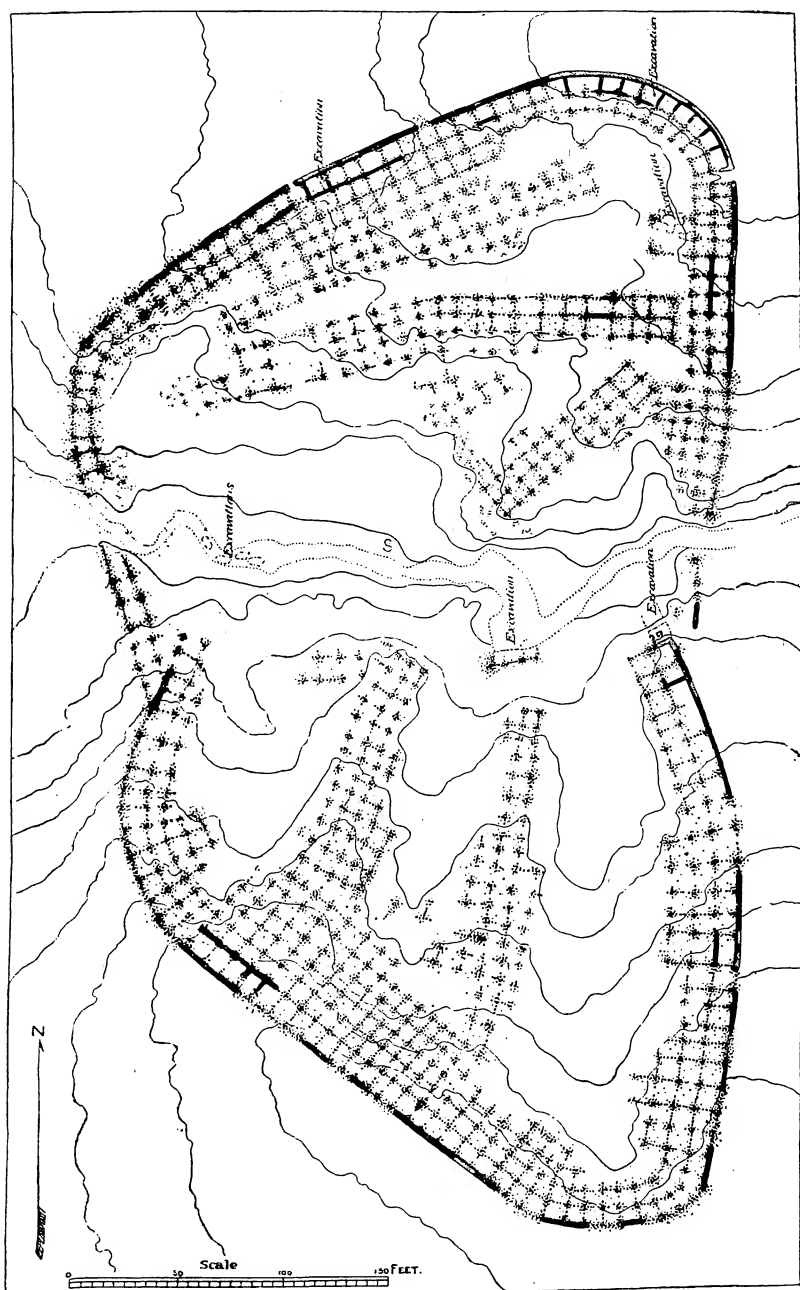


FIG. 23.—Plan of Kin Tiel.

Reproduced from plate LXIII, 8th Annual Report, Bureau of American Ethnology. The "excavation" in the lower right corner, started by Mindeff, is our KT-II. Traditionally Kin Tiel is Zuni; architecturally it resembles Pueblo Bonito; in ceramics it is a mixture of types, while kivas are of the Hopi type. Kin Tiel was inhabited as late as 1285 A. D.

tion with Zuñi.¹ Excavation, however, proved the absence of charred timbers and we turned to another depression of similar appearance.

Contrary to expectations this second test revealed a rectangular room which differed only in non-essentials from similar chambers in present-day Hopi villages. We had no reason to expect a subterranean room of this type even though there was some justification for the belief that Kin Tiel was contemporaneous with prehistoric Hopi settlements of the late Pueblo III and early Pueblo IV horizons. We had noted no superficial evidence of Hopi culture, but Mindeleff had remarked² that large circular depressions often revealed rectangular rooms. This statement was based on the fact that he had found, only a few feet from our second excavation, the walls of a rectangular room which for lack of time he was unable completely to lay bare. We finished the work he started in this particular chamber (our KT-II) and the resultant floor plan closely resembles that of KT-I, the first kiva we excavated at Kin Tiel.

For a better understanding of the Hopi type of kiva let us consider this latter chamber (fig. 24). Its floor is divided into what we may call the kiva room and the platform, or alcove. On the elevated platform, spectators might gather to witness the rituals performed in the larger space where the "altar" appropriate to each ceremony was arranged and the accompanying prayer dramatized.³

It is probable that this kiva, KT-I, is the oldest of the Hopi type yet excavated, and while its shape seems to be a modification of the earlier rectangular kiva, such as those at Betatakin, for example, in this instance there appear to be two rooms combined and remodelled. This is indicated by the difference in construction of the two divisions: the walls of the platform are of masonry, whereas those of the kiva room are merely the adobe plastered sides of a hole dug into hard-packed sand. The kiva floor, or area devoted to ceremonial purposes, is both wider and longer than that of the platform, though both were under the same roof.

Other general characteristics of the special type noted in KT-I are: offsets or jogs, in the side wall where the kiva room and platform alcove meet; the deflector, or fire screen; the firepit; the ventilator, in the lower face of the platform; the ventilator passageway beneath

¹ 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 92.

² 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 93.

³ A detailed architectural description of the Hopi kiva of the nineteenth century is given by Mindeleff in *A study of Pueblo architecture*, Tusayan and Cibola. 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7.

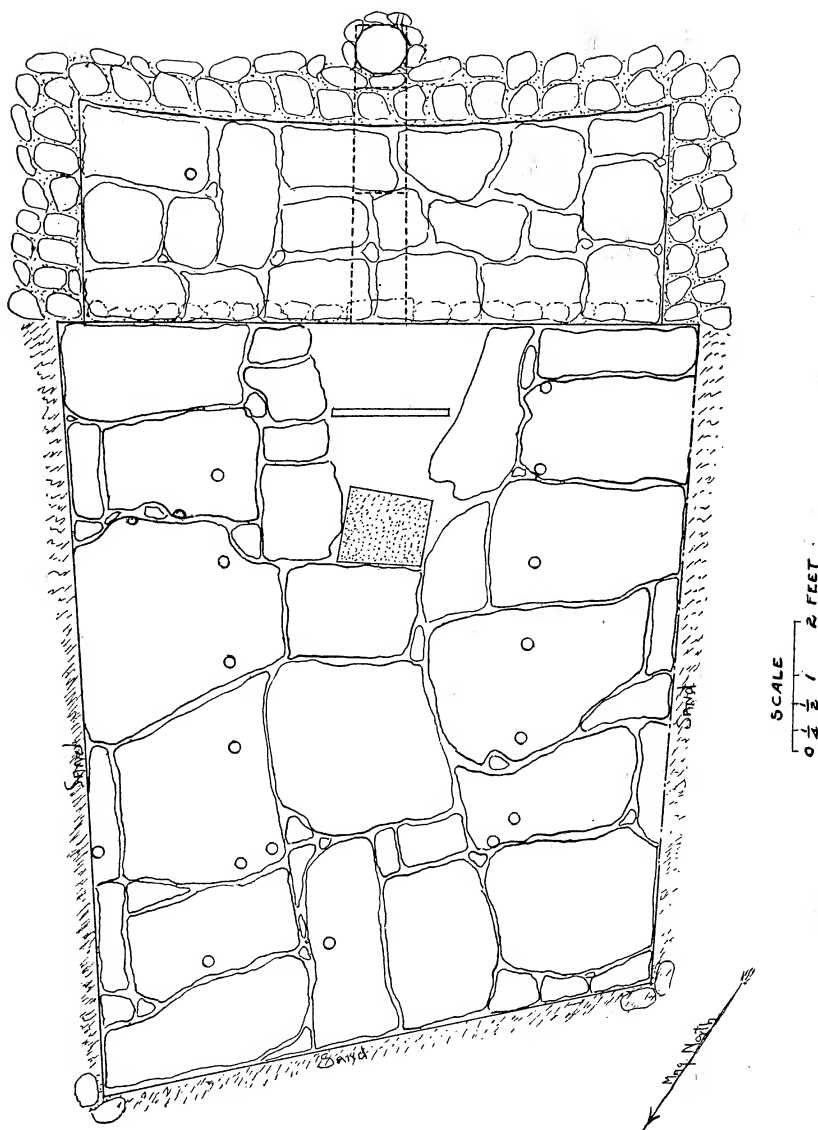


FIG. 24.—Plan of Kiva KT-I.

KT-I is probably the oldest of the Hopi type kiva yet reported. In arrangement it is typical, being divided into two sections, the kiva-room and platform, with offsets at the junction of the kiva-room and platform. It has a fireplace, a deflector, and a ventilator passing under the platform and connecting with an airshaft on the outside. KT-I is unique because the kiva-room was excavated in a sand dune without the support of masonry walls—a poor practice as the collapse of the walls carried down the roof which crushed five men. KT-I was constructed and destroyed in 1276 A. D.

the platform and outer wall; and the ventilator or air shaft connecting with the passageway outside of the kiva wall. Banquettes and pilasters are absent in both KT-I and II, and the presence of a sipapu is questionable.

The ceiling height is not known, but in the northeast and southwest corners, 6 feet 11 inches above the floor, three courses of masonry remain as a possible support for the original roof timbers. The roof was probably just above ground, as is the case with the older historic Hopi kivas. The original ceiling height is estimated to have been between 7 and 8 feet.

In determining the length of the chamber, the raised platform alcove must be considered, for it is really a part of the same room. In KT-I, the depth of the platform is 4 feet 1 inch; this, added to the length of the kiva room, makes a total length of about 17 feet. Overlooking the principal floor area as it does, the platform provided space for spectators just as we saw them during practice of the Bean Dance at Oraibi in 1928.¹

In front of and on each side of the platform alcove is a jog or offset (pl. 21, fig. 1). That on the west is 8½ inches wide; that on the east, 6½ inches. Both offsets are of masonry abutting the cut banks which form the kiva walls.

As previously stated, the side walls of the kiva are of adobe plaster applied directly to the sandy face of the original excavation. I do not recall any other pueblo ruin so late as Kin Tiel in which plastered earth walls substituted for masonry. Only the firm condition of the sand bed made this possible. But that the builders were taking a chance is shown by the later collapse of the plastered banks.

The collapse of the roof was obviously caused by the caving of the west wall. That this accident came suddenly and without warning is evidenced by the fact that five men were caught between the settling ceiling and the floor. Two jumbled skeletons were on the southwest end of the platform. A few feet northeast of the fire-pit, and in a sprawled position with the head resting on a pile of tumbled rocks, was found the third skeleton, which was partly burned. The skull and upper part of the body were burned where they came in contact with the burned part of a large juniper beam. The lower part of the skeleton, lying free from the beam, was excellently preserved, being covered with wind-blown sand that had sifted through the roof. Two tubular bone beads, several large circu-

¹ Nat. Geogr. Mag., Vol. 56, No. 6, p. 755. Washington, 1929.

lar beads of a white chalky material, and a large flint point were found among the bones of the body. Fragments of both black-on-orange and corrugated pottery were under this skeleton, and on the floor nearby were sherds of black-on-white ware. The fourth skeleton was in the northeast corner, in a flexed position on the floor, with face toward the firepit, and only partially destroyed by fire. Wind-blown sand had sifted through the roof and covered the bones. Sherds similar to those with skeleton no. 3 were found near skeleton no. 4. Mixed with the charred bones of the latter were hundreds of blow-fly pupae cases that had been carbonized by the fire when the roof was burned. The fifth skeleton was found 3 feet 4 inches from the west wall, and 1 foot 6 inches from the north wall. The jaw was that of a youth whose burned bones were found 2 feet above the floor, resting upon the collapsed wall.

The presence of blow-fly pupae cases seems to explain why the kiva was burned, and from the facts found the story of the tragedy may be partially reconstructed. In time the natural earth walls of the kiva probably became so weakened by the weight of the roof, and from the absorption of moisture, that the west wall caved in. Five men were trapped and lost their lives. That the kiva and its unfortunate occupants were not entirely burned at the time of the accident is manifest by the occurrence of the carbonized pupae cases of the blow-fly, and can only mean that the structure was fired after the men had been dead for some time. From the proximity of dwelling rooms to the scene of the disaster, we might infer that the ruined kiva was intentionally fired for sanitary purposes.

Pueblo custom decrees that the kiva be partly if not wholly underground. Even among the Hopi, whose villages stand on rocky buttes, kivas are often built on a lower sandstone ledge. With at least one side abutting the cliff face the prescribed subterranean, or semi-subterranean, position was thus realized without excavation of solid rock—a tedious task for folk not formerly possessed of metal tools.

Returning to Kin Tiel, the masonry walls at the platform end of Kiva KT-I were excellently constructed of hard, fine-grained sandstone. This sandstone, possessing definite lines of cleavage, could with little effort be split into blocks of fairly uniform size. The average size is about 2 inches thick and 10 inches long. Breaking of joints and dovetailing of corners was practiced but neither occurred consistently. The mortar was fine, sandy and sparingly used because the flat surfaces of the building stones fitted easily together.

The floor of KT-I, and that of the platform as well, is of smoothly worn irregular sandstone slabs averaging 1 inch in thickness and about $2\frac{1}{2}$ by 3 feet square. In the stone floor, 2 feet 9 inches from the east wall, are five holes in line. They average approximately $2\frac{3}{4}$ inches in diameter and 19 inches from center to center. On the opposite side of the kiva is a row of six similar holes, slightly closer together, this second series being 14 inches from the base of the platform, whereas the first hole in the other row lies 2 feet 10 inches from the platform. Of six other holes, five lie in the main part of the floor; one, in that of the platform. Since these latter six were either plugged with clay or a sandstone stopper, it is believed that they had been abandoned and superseded by the two series above described. It is also a possibility that the slabs in which they occur may have been salvaged from other rooms and re-used.

A possible explanation of this belief may be the clay-plugged hole which lies 4 feet 6 inches from the north wall and 3 feet 3 inches from the east. The position of this hole, primarily, prompts a suggestion that it might be a sipapu, but it is not in line with the firepit, deflector, and ventilator, and it is too far removed from the firepit which, itself, is not carefully oriented (fig. 24). A careful examination of the earth beneath this hole revealed only undisturbed soil; not the clay-lined cylinder anticipated.

From our observations it would appear that only the two series of five and six holes, respectively, were in use at the time Kiva KT-I was abandoned. As to their functions, two theories have been advanced. The first is that such holes were used to anchor the lower end of a loom, a theory to which the writer subscribes. It is well-known that Hopi men have long woven blankets in their kivas.

The second and quite improbable explanation is advanced by a Hopi who admitted that while such holes are often used in fastening the looms to the floor their real purpose is ceremonial. According to our informant, holes such as those under discussion were designed to hold freshly grown plants. The writer has not observed flagstone floors in modern Hopi kivas nor has he seen this arrangement of round holes. In Hopi ceremonial chambers a square log or plank with a series of small rectangular holes is buried in the floor on either side.¹ These rectangular holes are definitely made for weaving. They may lie not only in the floor proper, but at either side of the platform, and even at the ends of the kiva, and cut as they are in

¹ Mindeleff, Victor, *A study of Pueblo architecture*, Tusayan and Cibola. 8th Ann. Rep., Bur. Amer. Ethnol., 1886-7, p. 132.

wood, they are entirely unsuited for potting plants. And yet it might be that, in prehistoric times, such floor holes served this dual purpose; that some tradition of that dual function has survived until the present.

The firepit, 3 feet $1\frac{1}{2}$ inches from the base of the platform, is in line with the ventilator and deflector, though not parallel to the latter. Though the length of the sides is not consistent, averaging 1 foot $4\frac{1}{2}$ inches, the firepit approximates a square. It is 7 inches deep and lined with clay-coated slabs of sandstone, but no evidence of the corners being rounded with clay was found. The top of the pit is flush with the floor of the room.

Seventeen inches from the firepit, and between it and the ventilator, was a deflector—a sandstone slab with rounded top and corners. The deflector is $1\frac{1}{2}$ inches thick, 2 feet 2 inches wide and 2 feet 1 inch high. It was set several inches deep into the floor and so firmly that it was broken off just above the floor by the falling roof. Though cleanly broken when found, it was still in an upright position supported by fallen débris. The narrow space between the deflector and platform was the only part of the kiva floor not paved with flagstones. Beneath the clay-surfaced area loose earth and rocks were found.

At the south end of the kiva, 19 inches from the deflector, was the platform (pl. 21, fig. 1) which was 2 feet $6\frac{1}{2}$ inches high and 4 feet wide. The vertical face of this platform as well as the natural walls of KT-I were coated with plaster. Upon this plaster was a coat of white-wash. As is usual in kivas of this type, fresh air was drawn in through a vertical shaft outside the walls of the chamber, through a passageway beneath the platform and thence by means of an opening in the middle front. In KT-I, this opening measured 12 inches wide by 22 inches high; its lintel consisted of two superposed sandstone slabs, 6 or 7 inches wide and separated by adobe mortar, making a total thickness of 6 inches. The total length of the passageway from the entrance in the face of the platform to the back of the air shaft was 5 feet $6\frac{1}{2}$ inches. The passageway, or ventilator duct, was roofed with small sticks covered by a $4\frac{1}{2}$ -inch layer of adobe mortar as a support for the flagstones of the platform. Most of these sticks had decayed but their imprints remained where the passageway had not collapsed under the weight of the falling roof. Like the sides of the ventilator opening, the duct walls were of undisturbed earth, heavily plastered with clay. At a point 2 feet 5 inches from the entrance was a plastered step 1 foot high. This level continued back to the base of the shaft where the width narrowed to 11 inches. Between the step and the shaft the height of the passageway remained 10 inches.

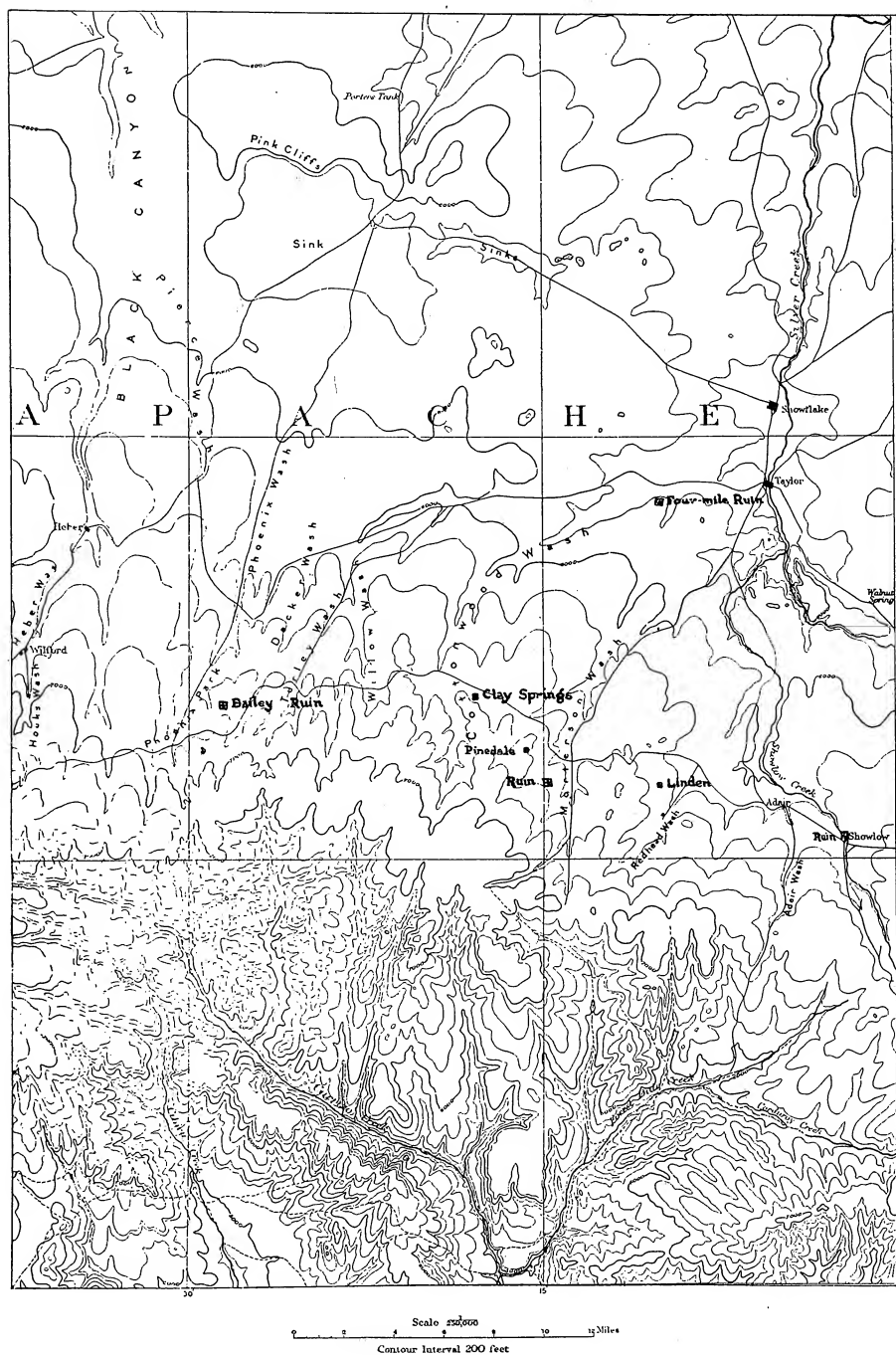
The ventilator shaft was built of sandstone blocks somewhat smaller than those used in construction of the room walls. The base of the shaft, where it opened to the passageway, was slightly D-shaped and averaged 14 inches in diameter. A short distance from the bottom, the shaft became circular; at its present top, 7 feet 6 inches above the duct floor, it was octagonal and 11½ inches in diameter. The upper portion of the shaft had collapsed with the wall against which it stood.

The roof construction of KT-I may be approximated by the burned material found in the northwest end of the chamber. Beams 3 to 5 inches in diameter had spanned the room and supported the customary series of ceiling poles. Upon these was a layer of brush and grass overlaid by several inches of adobe mud. The thoroughly charred timbers had been broken into fragments rarely more than a foot in length. Among these we recognized only one pine beam; all the others were either piñon or juniper. About the firepit and deflector were a number of sandstone slabs that obviously had fallen with the roof. Their positions suggest that they probably rimmed the kiva hatchway and that the latter, as in modern Hopi kivas, were above the firepit. If this supposition is correct, then the chamber was entered by means of a ladder extending through the hatchway and resting on the platform floor.

On removing the wind-blown sand and fallen roof, midden débris was found in quantity, and in such position that it was obviously not thrown through the roof entrance but through the hole left by the collapse of the west wall. At this point the top of the midden was 4 feet 2 inches above the floor, which, however, was not the greatest depth of débris, since the bottom of the midden rested upon the fallen wall. Transversely, the midden extended from the face of the south wall to the north edge of the firepit (see drawing). From the firepit to the north wall the roof rested upon the floor.

The midden fill of KT-I was principally of wood ash, scattered through which were discarded stone implements, bone awls, turkey and small-mammal bones, and quantities of potsherds of black-on-white, corrugated, and a ware of a peculiar shade of orange decorated in black. Differences and even local characteristics have been noted, though a more comprehensive study of the sherds collected will have to be made before these differences can be adequately defined.

While excavating KT-I, a flexed burial was found, though no relation to the conditions in the kiva was indicated. In the northeast corner, on top of the fallen roof and 2 feet above the floor, the



body was found against the wall and curved around the corner with the head against the east wall, though facing west. The bones were so well preserved that the skeleton was removed for later study. Between the skeleton and the roof were two sandstone slabs in a vertical position, across which the skeleton lay. The slabs appeared to be part of the fallen roof support, rather than those of a burial cist. In a horizontal position on top of the skeleton lay a flat, oval stone 1 foot wide, and 1 foot 8 inches long upon which was a crushed corrugated olla. The skeleton was found 4 feet 5 inches below the top of the excavation in alternating layers of sand and human excrement, overlaid by about 2 feet 6 inches of adobe. The kiva at this point was filled with rocks that were once a part of adjacent dwelling rooms.

ARTIFACTS

With the exception of the beads and flint point found with burial number 3, the only artifacts found came from the midden. Among these discards were three types of stone axes; single and double groove encircling the head, and three-quarter groove. *Manos* were of two types: oval with two flat sides, and triangular. Similar grinding stones are in use among the Hopi today, each type serving a different purpose. Metates of fine-grained stone, of which three were found, are used with the triangular *manos* to produce the finest meal. Hammerstones, pottery polishing stones, pot lids worked from thin sandstone tablets, a pestle, wedge, an "arrowshaft straightener," two stone mauls, and a triangular piece of sandstone grooved at two corners and weighing about four pounds, were also found.

KIVA KT-II

A depression just southeast of KT-I proved on excavation to be a second kiva, which we designated KT-II (fig. 25 and pl. 21, fig. 2). The two ceremonial chambers are not exactly in line, however, since the southwest corner of the platform in KT-I is only 12 feet from the northwest corner of KT-II, while the southeast corner of the platform is 15 feet from the northeast corner of KT-II. This difference indicates that the kivas, though facing the southwest, varied as to the number of degrees, a condition frequently noted in structures of this type. The interval between the kivas was not examined, but from its size and position it is thought to contain a room.

In comparing the kivas only minor differences were noted. They are of the same type and approximately the same size, though KT-II

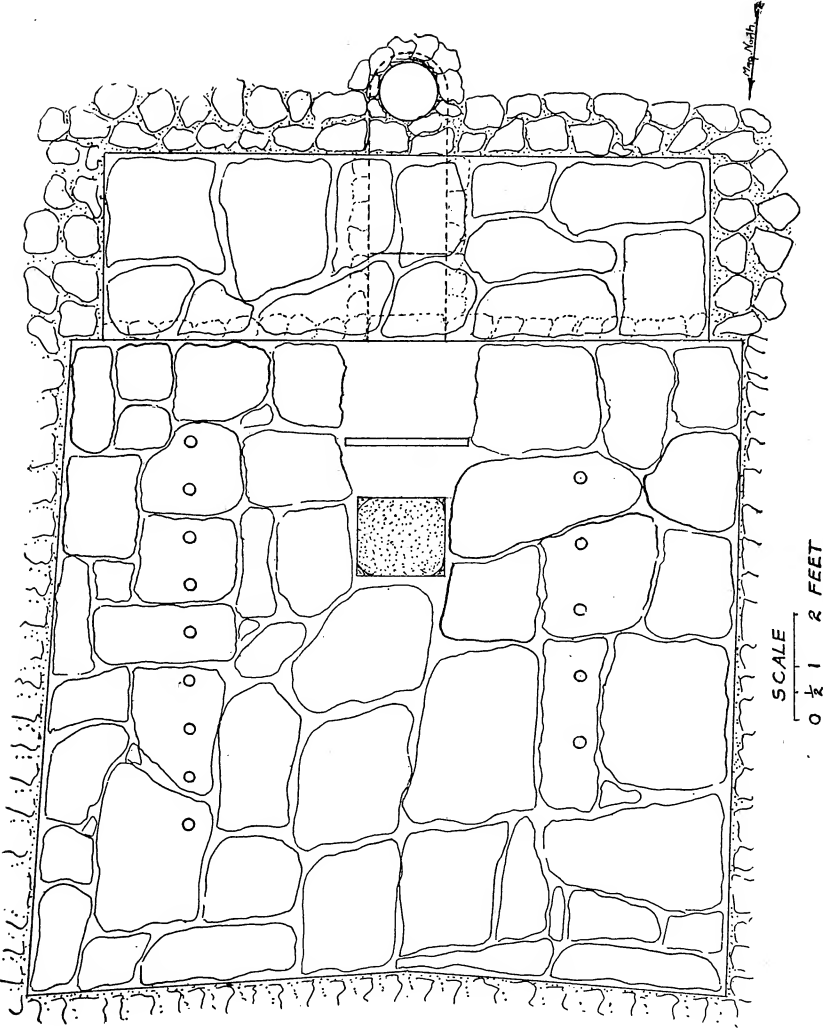


FIG. 25.—Plan of Kiva KT-II.

KT-II was constructed during the same year as KT-I and was probably built after the destruction of the former. It was far superior to KT-I both in workmanship and materials used. From a repair timber we know it was in use in 1285 A. D.

was not so deeply set into the ground. The masonry of KT-II is of the same type and material, but the method of construction is slightly different. The walls at the southeast and southwest corners of KT-II are joined together, but abut at the northeast and northwest corners where wedges were driven between to strengthen the walls (pl. 22, fig. 1). The tying of the walls in the two corners noted is well done and appears to have been intentional. All four walls are of masonry, plastered, and firmly constructed, contrasting greatly with the insecure walls of KT-I. The walls were straight and firm, with the exception of the north and south sides which were slightly bowed inward from pressure of the material against them.

The room floor consists of sandstone slabs of the same material and comparable in size to those in KT-I. On the east side of the floor are five holes, in line and averaging 11 inches from center to center. On the west side is another series of holes, averaging 15 inches apart. All holes are approximately $2\frac{3}{4}$ inches in diameter. That they were probably for the purpose of fastening loom frames to the floor is indicated by the fact that both series were immediately beneath roof beams running parallel with the series. The charred remains of these beams may be seen in the accompanying photograph (pl. 22, fig. 2). No evidence of a sipapu was found.

The roughly squared firepit is 3 feet $3\frac{1}{2}$ inches from the base of the platform, and is in line with the ventilator and deflector. The pit, 10 inches deep and lined with clay, is flush with the floor; its corners are rounded.

The deflector, a sandstone slab 1 foot $10\frac{1}{2}$ inches from the ventilator, is 1 foot 10 inches high, 2 feet $4\frac{1}{2}$ inches wide, and $1\frac{3}{4}$ inches thick. The top is slightly rounded and the base is firmly set in the floor.

As in KT-I, the ventilator entrance is in the front side of the platform, which lies 2 feet 6 inches above the floor. Across the bottom of this entrance, 18 inches wide by 23 inches high, is a sill 4 inches high; across the top, a sandstone lintel. The roof of the passageway had been composed of small twigs, placed close together and covered with adobe as in KT-I. Over this roof, which is 3 inches thick, are the flagstones of the platform. From front to back, the width of the platform is 3 feet 6 inches (fig. 25); the length of the passageway, including the base of the air shaft, is 5 feet 6 inches. The sides of the passageway are of masonry, and still show signs of plaster. In the passageway, 20 inches from the entrance, is a clay step 1 foot high. The floor is paved from the entrance to this step,

the remaining portion being of unplastered earth. The masonry walls follow the level of the floor, rising at the step and inclining slightly to the base of the air shaft which is D-shaped, with a diameter of 15 inches. Just above the base, the shaft is circular and 15 inches in diameter; its diameter decreases toward the top. No idea of the original height of the shaft could be ascertained since the south wall, against which the shaft was built, had collapsed, falling on the platform and breaking through the passageway.

Like its neighbor, KT-II was also destroyed by fire. Charred roof beams were on the floor and though they were for the most part completely burned, their position gives an idea of the arrangement of the roof. Three feet, one inch from the east wall was a pair of beams, each about 3 inches in diameter. Fragments of this pair were found at intervals for the entire north-south length of the kiva. Along the west side, 2 feet 11½ inches from the wall, was another pair of beams, also averaging 3 inches in diameter. These two pairs extended over the platform. In the middle of the kiva and parallel to those at each side was a third pair of beams, of approximately the same diameters as the others. Between these paired timbers were single poles but so completely burned that it was impossible to determine their spacing or diameter. Extending from east to west at intervals and resting upon the principal beams, were smaller logs, in pairs. One such pair lay against the north wall, while another pair crossed the kiva between the deflector and the platform. A third pair crossed the kiva about 2 feet north of the firepit. These last two pairs probably sustained the added weight around the entrance which, in kivas of this type, is in the ceiling over the firepit.

Evidence of the use of grass or brush in roof construction was found, but only in the northeast corner could the order be determined. Here was charcoal where the east-west timbers crossed the north-south beams; upon the latter was a charred mat of grass or twigs, covered with several inches of adobe. The clay of the roof was covered with wind-blown sand, through which were scattered a few potsherds, but the greater part of the depression between the fallen roof and ground level was filled with rocks from nearby walls.

Between the ventilator and the deflector, the only portion of the floor not paved with flagstones, were found three smooth stones, a large flint core, and a stone maul about 3 inches in diameter and 5 inches long with a groove encircling the middle. Between the deflector and the firepit were fragments of a corrugated olla, shattered by the fallen roof. The base of this olla lay near the firepit and still

contained pieces of small bones while part of the top and side was found in the pit. The only decorated pottery found on the floor were a few black-on-white sherds but as no two belong to the same vessel we assume they had weathered from the mortar of the walls. On top of the fallen roof, however, black-on-white sherds and other fragments of an unusual shade, somewhat between brown and orange, with black decoration were found mixed with the rocks and sand. Sherds from KT-II, in general, are the same types as those from KT-I.

DATING THE KIVAS

When selecting Kin Tiel for excavation it was hoped that a good selection of datable pine timbers would be recovered. The surrounding forests today consist almost wholly of piñon (*Pinus edulis*) and juniper (*Juniperus monosperma*) with here and there a lonely yellow pine (*Pinus ponderosa*). We may infer that comparable conditions obtained during the occupancy of Kin Tiel for, in the two rooms we cleared, only one pine timber was found and this, unfortunately, proved too complacent for dating. We may rejoice, however, in the fact that Doctor Douglass and Mr. Haury, concentrating upon the most promising of the material in hand, finally succeeded in determining the cutting dates of 27 piñon beams used in the two kivas.

Of this number, 13 were from KT-I and of these six were cut between A. D. 1264 and 1270; one in 1274; four in 1275; and two in 1276. The collecting of building material usually requires some time, at least among the Hopi, for never are beams plentiful in this region even since the advent of the telephone pole. My personal observations confirm this fact. We believe, therefore, that the building date of KT-I is 1276 rather than 1275 A. D., the year of preparation; that the earlier dates evidence re-use of timbers.

Of the 14 dated specimens from KT-II one was cut in 1266; one in 1272; nine in 1275 (four of these are from the same tree); two in 1276; and one in 1285. It is obvious from the grouping of these dates that the accumulation period was during 1275, and that KT-II was therefore probably constructed at about the same time as KT-I, sometime during 1276 A. D. It is a significant fact that KT-I had no timbers cut later than its supposed building date, which, in view of the unexpected collapse of the walls, suggests that it was destroyed soon after construction—probably when the summer rains saturated the sand walls. In contrast, KT-II was in use for at least ten years before its final abandonment, as is shown by the date 1285 which

doubtless marks a bit of repair. That the longer life of KT-II is due to better workmanship than that of KT-I is obvious from the manner in which the latter was destroyed. This, and the fact that both kivas were constructed during the same year, suggests that KT-II was built shortly after the destruction of KT-I.

SUMMARY

In brief, the season's work at Kin Tiel has contributed to southwestern archeology (1) by furnishing plans and details of construction of two kivas—the earliest of the Hopi type yet reported; (2) by determining the building dates of these kivas; (3) by showing the Hopi relationship of a pueblo that traditionally has been considered as Zuni; and (4) by securing new pottery types definitely associated with dated beams.

KOKOPNYAMA

The prehistoric Hopi Pueblo, Kokopnyama, lies 1 mile east of the Jeddito Trading Post, on the north side of Jeddito Valley and a few miles south of the Indian Agency at Keams Canyon, in central Navajo County, Arizona.

The Hopi mesas, of sandstone underlayed with shale, serve as natural water reservoirs while the broad valleys on either side are filled with alluvial deposits. Since the dip of the rocks is toward the south, numerous springs dot the south side of the mesas. In a desert region where permanent springs are few, such favorable conditions for permanent homes were eagerly sought by the aboriginal inhabitants and remains of their habitations are found in great number under the mesa rims. Though soil and water are the most important, other factors aided in making Jeddito Valley an important culture center in prehistoric times. The valley floor was green with herbs and grasses; the bordering mesas were covered with shrubs and timber (*Juniperus monosperma* and *Pinus edulis*). A few miles to the north and east were pine (*Pinus ponderosa*) and fir (*Pseudotsuga taxifolia*). Sandstone was available for building material; and deposits of clay and veins of coal were visible along the mesa slopes.

The earliest historical reference to the Jeddito Valley is included with an account of the discovery of Awatobi, visited in 1540 by Tobar and Cardenas with a small detachment from the Coronado Expedition.¹ Later explorers to visit this valley were Espejo in 1583. Oñate in 1598, and De Vargas in 1692.² In the first half of the 17th century

¹ Winship, George P., The Coronado Expedition, 1540-42. 14th Ann. Rep., Bur. Amer. Ethnol., 1896.

² Bull. 30, Bur. Amer. Ethnol., 1912, pp. 560-61.

a Franciscan mission was established at Awatobi and this thrived until its destruction during the Pueblo Revolt of 1680. In 1700 an attempt to re-establish the mission failed and Awatobi was destroyed by the irate inhabitants of some of the nearby Hopi villages.¹

Our first archeological reference to Jeddito Valley is from Victor Mindeleff,² who in 1882-83 devoted much time to mapping the larger ruins, of which there are five. These are all situated on the north side of the valley and are well known to all students of Pueblo archeology as Awatobi, Kawaioku, Chakpahu, Nesheptanga, and Kokopnyama. In 1892 limited excavations were made at Awatobi by the late Dr. J. W. Fewkes of the Smithsonian Institution,^{3, 4} who was followed, in 1907, by Dr. Frank Russell of Harvard.

With the exception of the survey made by Mindeleff, no archeological investigations were made at Kokopnyama until 1901 when Dr. Walter Hough of the Museum-Gates Expedition spent several weeks in the valley.⁵ In 1917 Spier, of the American Museum of Natural History, undertook a pottery survey,⁶ and in 1923 and 1926 Kidder made a stratigraphic test at Nesheptanga and surface examinations at other ruins.⁷ These are the archeological investigations made prior to the spring of 1928, when the writer determined a pottery sequence for Pueblo IV ruins in the Hopi country.

GENERAL DESCRIPTION

A surface survey of Kokopnyama reveals a ruin about ten acres in area with architectural features not unlike those of modern Hopi pueblos, if recent influence in the latter is disregarded. The general plan is essentially the same with house groups two or more stories in height surrounding open courts. Middens often contain pottery types of different periods. From this condition we surmised that new structures were erected in unoccupied portions when a building had become unsafe for living. Later investigations confirmed this supposition. This shifting back and forth of buildings as decay set in is found at the older inhabited Hopi towns. Having previously deter-

¹ Bull. 30, Bur. Amer. Ethnol., 1912, p. 561.

² 8th Ann. Rep., Bur. Amer. Ethnol., 1887

³ Hough, Walter, Ann. Rep., U. S. Nat. Mus., 1901, p. 333.

⁴ Fewkes, Jesse Walter, Expedition to Arizona in 1895. 17th Ann. Rep., Bur. Amer. Ethnol., Pt. 2, p. 592.

⁵ Ann. Rep., U. S. Nat. Mus., 1901, pp. 279-358.

⁶ Spier, Leslie, An outline for a chronology of Zuñi ruins. Anthropol. Papers, Amer. Mus. Nat. Hist., Vol. XVIII, pt. 3, New York.

⁷ Kidder, A. V., Southwestern archaeology.

mined the sequence of Hopi pottery types, it was easy to select that part of the ruin where beam material of the desired age might be found. Only the presence or absence of charred or decayed pine would affect the success of our 1929 work.

The accuracy of Mindeleff's survey of the site was confirmed through several tests, and having definitely located a point in the ruin corresponding to a known point on his map, we established a permanent benchmark. From this point a base line was run through the ruin. At convenient points cement monuments were erected from which all tests and excavations were accurately plotted.

After selecting a section to be worked, it was found that Mindeleff had considered only well-defined room outlines, probably considering the talus on the mesa slope to be fallen walls from rooms above. Tests along the slope, however, revealed midden-filled rooms with *débris* containing sherds of late Pueblo III and early Pueblo IV types. The greater part of the pueblo occupied in late Pueblo III and early Pueblo IV is then found to be outside of the ruin as mapped by Mindeleff, the heavy lines outlined by him giving a fair idea of the area occupied in late Pueblo IV (fig. 26).

DWELLING ROOMS

The distinctive characteristic of Kokopnyama masonry is the poor quality of stone used. This material, Mesa Verde sandstone, is friable and easily "blocked," but is unfit for "dressing." Also, because of its softness, this stone is readily affected by weathering, which accounts for the crumbled condition of exposed walls although Kokopnyama is much more recent than many ruins of the Southwest whose walls, excellently preserved, are constructed of more durable stone.¹ Clay used for mortar was dug from shale beds within the Mesa Verde sandstone formation, and occurs in quantities under the mesa rim.

Of the rooms we opened all vary somewhat in size (fig. 27). The normal thickness of walls is about 12 inches, though walls 24 or more inches in thickness are not unusual where strengthening measures were found necessary. No orderly arrangement of blocks was found, both large and small stones being used at random; nor was any attempt at coursing apparent in those walls examined. The granular surface of the walls was protected by coats of natural, yellow-clay plaster—as is common today among the Hopi. Plastering seems

¹ 22nd Ann. Rep., Bur. Amer. Ethnol., 1904, p. 134.

to have been confined to the interiors of rooms at Kokopnyama, however, and though some Hopi dwellings with plastered exteriors are found, they are few—the practice having been introduced into this

Size of Rooms

<i>Rooms</i>	<i>Length</i>	<i>Width</i>	<i>Depth</i>	<i>Door</i>	<i>Cache</i>	<i>Firepit</i>	<i>Mealing bin</i>
R-2	11' 9"	8' 2"			Yes		
R-3	6' 9"	6' 7"		Yes			
R-6	6' 6"	5' 2"					
R-7	7' 1"	4' 8"					
R-8	7' 4" 6' 10"	5' 6" 5' 4"					
R-9	8' 4"	6' 9" 6' 6"	5				
R-10	10' 8' 6"	6' 1"				Yes	
R-10a	8' 6"	6' 1"		Yes			
R-11	6' 10"	6' 6"	4' 3"	Yes	Yes		Yes
R-13	6' 6"	4' 6"					Yes
R-13a	?	?	5' 6"				Extends under R-11
R-14	11' 4" 12' 9"	9' 2" 8'					
R-15	9' 1" 9'	7'			2		
R-16	6' 11"	3' 10"					
R-17	8'	8'					
R-18	10'	9' 6"			Yes	Yes	
R-9a	8'	8'					
R-21	5'	5'					
R-22	11'	7' 9"					Yes
R-25	14'	7' 6" 8'	6				

FIG. 27.

region within recent years. Decoration of walls with painted designs, or with incised drawings was not found, though incised stones were found detached from the walls. Both methods of decoration have been found at Kawaioku, a nearby ruin occupied at the same time as

ing up a tree-ring chronology. The accessibility of pine caused much of it to be incorporated into the roof structures of the pueblo. Hence rich returns of wood either in the normal state or charred could be expected.

The ruin is first mentioned in literature by Mr. A. F. Bandelier¹ who examined it briefly in April, 1883, during his extensive survey of ruins in the Southwest. His description of the site is as follows:

. . . . The ruin is that of a communal pueblo consisting of two houses with one circular estufa. The walls are 0.20 m. (about 8 inches) thick, built of sandstone, and only the foundations remain. Situated on a rise above a fertile bottom, this pueblo occupied a good position both for agriculture and defence.

In July, 1901, Dr. Walter Hough,² Director of the Museum-Gates Expedition, spent several days in excavation at Showlow ruin. He refers to it, however, as the Huning ruin, as at that time and when Bandelier was there as well, it was on the ranch of Mr. Henry Huning. Hough, in a brief description of his work at Showlow, says:

The Huning ruin is a good example of the rectangular pueblo, showing considerable skill in laying out a village. The masonry exposed during the excavations is good; the material is of blocks of Carboniferous sandstone. . . . It seems probable that the pueblo was inhabited only for a short time.

The change in name from Huning to Showlow ruin, as it is here called, seems legitimate in view of the fact that Bandelier referred to it as *the* ruin at Showlow, rather than naming it after the man on whose ranch it was located. Furthermore, its identity will be longer retained when connected with Showlow instead of a ranch name which has almost been forgotten.

Prior to 1901, a residence had been built on the extreme south end of the ruin. In 1903, the land on which it is located was acquired by Mr. Edson Whipple, who owns the major part of the pueblo at the present time. In the same year Mr. Whipple erected his house on the northern extremity of the ruin, and subsequently put up a barn, workshop, blacksmith shop and other sheds. A few years ago, the third house was erected on a razed space near the center of the pueblo. In still other sections, crumbled walls have been leveled for garden spaces and for a roadway. Many wagon-loads of rock have been removed for building purposes since the Showlow settlement was started. Hough notes that "during this process (of removing stone) a room at the south end of the pueblo was found to contain a large amount of charred corn, beans, etc." This room was later roofed

¹ Bandelier, A. F., 1892, pp. 392-393.

² Hough, Walter, 1903, p. 301.

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RECENTLY DATED PUEBLO RUINS IN ARIZONA

(WITH 27 PLATES)

BY
EMIL W. HAURY and LYNDON L. HARGRAVE



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